$ AR1268C

PTO/SB/21 (09-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission	100

Application Number	09/401,584
Filing Date	September 22, 1999
First Named Inventor	Gavrilovich, Charles D.
Art Unit	2686
Examiner Name	Joy K. Contee
Attorney Docket Number	Gavrilovich-P1US2

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [x] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Itemized Postcard
Credit Card Payment Form
Final Office Action dated 1/3/2005
Patent No. 5282239
Application as Filed

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Gavrilovich, Dodd, and Lindsey, LLP		
Signature			
Printed name	Charles D. Gavrilovich, Jr.		
Date	May 12, 2006	Reg. No.	41,031

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature			
Typed or printed name	Charles D. Gavrilovich, Jr.	Date	May 12, 2006

PTO/SB/17 (12-04v2)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 250.00

Complete if Known	
Application Number	09/401,584
Filing Date	September 22, 1999
First Named Inventor	Gavrilovich, Charles D.
Examiner Name	Joy K. Contee
Art Unit	2686
Attorney Docket No.	Gavrilovich-P1US2

METHOD OF PAYMENT (check all that apply)

☐ Check ☑ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☑ Deposit Account Deposit Account Number: 502484 Deposit Account Name: _____

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims		Extra Claims		Fee ($)		Fee Paid ($)
_____	- 20 or HP =	_____	x	_____	=	_____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		Extra Claims		Fee ($)		Fee Paid ($)
_____	- 3 or HP =	_____	x	_____	=	_____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

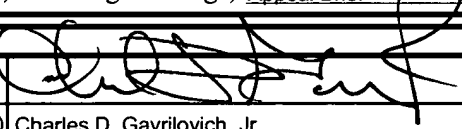
If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof		Fee ($)		Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____	(round up to a whole number) x	_____	=	_____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	
Other (e.g., late filing surcharge): Appeal Brief	250.00

SUBMITTED BY

Signature		Registration No. (Attorney/Agent) 41,031	Telephone 619 271 0382
Name (Print/Type)	Charles D. Gavrilovich, Jr.		Date May 12, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Charles D. Gavrilovich	Examiner:	Joy K. Contee
Serial No.:	09/401,584	Group No.:	2681
Filed:	September 22, 1999	Docket No.	Gavrilovich P1US2
For:	**MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION**		

CERTIFICATION UNDER 37 CFR § 1.8

I hereby certify that the documents referred to as enclosed herein are being deposited with the United States Postal Service as first class mail on this date May 12, 2006, in an envelope addressed to: Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

May 12, 2006 _____
Date

_____
Signature
By: Charles D. Gavrilovich, Jr.

05/16/2006 SHASSEN1 00000016 09401584
01 FC:2402 250.00 OP

Mail Stop Appeal Briefs – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANT'S APPEAL BRIEF UNDER 37 CFR §41.37

In accordance with the Notice of Appeal to the Board of Patent Appeals and Interferences mailed March 27, 2006 and received on April 04, 2006, in the above-identified U.S. Patent application, Appellant hereby presents the Appellant's Appeal Brief under 37 CFR §41.37. The APPELLANT'S APPEAL BRIEF is submitted with copies of each reference discussed and a copy of the Final Office Action as well as the appropriate fees.

REAL PARTY IN INTEREST

Carucel Investments Limited Partnership of Park Ridge, Illinois is the real party in interest as the assignee of the above-identified application.

RELATED APPEALS AND INTERFERENCES

No other appeals or interferences are known which will be affected by this appeal.

STATUS OF CLAIMS

In the Final Office Action dated October 03, 2005, the Examiner has provided the following status of the claims. Claims 63-82 and 97-102 are allowed. Claims 50-53, 55-60, 90-92, 94-96,104-106, are objected to as being dependent on a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 118 is objected to because of informalities. Claims 30-36, 49, 54-62, 89-96, 93,103-106 and 113-123 are rejected. Appellant is concurrently filing an amendment canceling claim 118. Accordingly, the application under appeal includes pending claims 30-36, 49-82, 89-106 and 113-123. The claims involved in the appeal include claims 30-36, 49, 54-62, 89-96, 93,103-106 and 113-123.

Claims 30-36, 49, 54, 58, 61, 62, 89, 93,103, 113-123 stand rejected under 35 USC §102(b) as being anticipated by Yokoi et al. (US 5,282,239) ("Yokoi").

STATUS OF AMENDMENTS

Amendments submitted March 25, 2005 have been entered. Appellant is submitting an amendment concurrently with this appeal canceling claim 118.

SUMMARY OF THE CLAIMED SUBJECT MATTER

In accordance with 37 CFR § 41.37(v), Appellant provides a brief summary of each independent claim involved in the appeal and each dependent claim argued separately, where each summary refers to the specification by page and line number and to the drawings by reference number. Appellant notes that this "Summary of claimed subject matter" is provided only to assist the Board in identifying portions of the specification related to the particular claims. In the interest of brevity, each claim summary does not necessarily include all references to all relevant portions of the specification and drawings. Accordingly, omission of

any reference to the specification or to the drawings should not be construed in any way as an intent to relinquishment claim scope or term, or as an implication or statement regarding the conformance with 35 U.S.C. §112. Appellant respectfully submits that the claims should not be construed as being limited to the embodiments described or referenced in any claim summary and other embodiments, as well as the Doctrine of Equivalents, may apply in determining claim scope.

Claim 30

The subject matter of claim 30 is directed to an apparatus comprising a receiver configured to wirelessly receive a received signal and a transmitter configured to transmit a transmit signal corresponding to the received signal to a mobile unit 20. The transmitter has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit. The actual motion of the mobile unit 20 is independent of the motion of the transmitter. The specification describes a moving base station 30 having a radio interface 132 for communicating with the mobile unit 20 and a radio interface 132 for communicating with a fixed radio port 50. The receiver of claim 30 is part of the radio interface 132 that communicates with the fixed radio port 50 of moving base station 30. The transmitter is part of the radio interface 132 of the moving base station 30 that communicates with the mobile unit 20. (Application, page 8, line 25 to page 9, line 15 and FIG. 4). FIG. 1 illustrates an example where a moving base station 30 (including a transmitter) moves along a predetermined path (along a conveying device disposed along a roadway) and in accordance with an anticipated motion of the mobile unit 20 since the anticipated motion of the mobile unit is along the roadway. The application describes the example shown in FIG. 1 at page 5, line 5 through page 7, line 21.

Claim 31

Claim 31 depends from claim 30 and is further directed to an apparatus where the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit 20 is on the roadway 10, 15. (See FIG. 1 and page 5, lines 5-9.)

Claim 33

Claim 33 depends from claim 32 which depends from claim 31 and is further directed to an apparatus where the received signal is received from a fixed radio port 50. (See FIG. 2 and page 7, lines 22-23 and FIG. 1).

Claim 34

Claim 34 is directed to an apparatus comprising a receiver configured to receive a received signal from a mobile unit while the receiver has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit. The actual motion of the mobile unit is independent of the motion of the receiver. The apparatus also comprises a transmitter configured to wirelessly transmit a transmit signal corresponding to the received signal to at least one fixed port. The specification describes a moving base station 30 having a radio interface 132 for communicating with the mobile unit 20 and a radio interface 132 for communicating with a fixed radio port 50. The transmitter of claim 34 is part of the radio interface 132 that communicates with the fixed radio port 50. The receiver is part of the radio interface 132 of the moving base station 30 that communicates with the mobile unit 20. (Application, page 8, line 25 to page 9, line 15 and FIG. 4). FIG. 1 illustrates an example where a moving base station 30 (including a receiver) moves along a predetermined path (along a conveying device disposed along a roadway) and in accordance with an anticipated motion of the mobile unit 20 since the anticipated motion of the mobile unit is along the roadway. The application describes the example shown in FIG. 1 at page 5, line 5 through page 7, line 21.

Claim 35

Claim 35 depends from claim 34 and is further directed to an apparatus where the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit 20 is on the roadway 10, 15. (See FIG. 1 and page 5, lines 5-9.)

Claim 49

Claim 49 is directed to a movable base station 30 configured to establish a communication link between a fixed port 50 and mobile unit 20 while the movable base station 30 has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit 20. The communication link comprises a wireless communication link between the movable base station 30 and the fixed port 50. The actual motion of the mobile unit 20 is independent of the motion of the movable base station 30. (See FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 54

Claim 54 is directed to a movable base station 30 configured to have a motion relative to a fixed port 50 along a predetermined path and in accordance with an anticipated motion of a mobile unit 20. The movable base station 30 comprises a first radio interface 132 configured to establish a first wireless communication link between the movable base station 30 and the mobile unit 20 and a second radio interface 132 configured to establish a second wireless communication link between the movable base station 30 and the fixed port 50. The actual motion of the mobile unit 20 is independent of the motion of the movable base station 30. (See FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 61

Claim 61 depends from claim 54 and is further directed to a movable base station 30 where the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit 20 is on the roadway 10, 15. (See FIG. 1 and page 5, lines 5-9).

Claim 89

Claim 89 is directed to a method of transmitting a signal to a mobile unit 20 having an anticipated motion relative to Earth. The method comprises the steps of wirelessly receiving a received signal, controlling a motion of a transmitter along a predetermined path in accordance with the anticipated motion of the mobile unit, and transmitting a transmit signal corresponding to the received signal to the mobile unit. The motion of the mobile unit is independent of the motion of the transmitter. (See FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 93

Claim 93 is directed to a method of wirelessly transmitting a transmit signal corresponding to a received signal transmitted from a mobile unit 20 having an anticipated motion relative to Earth. The method comprises the steps of controlling a motion of a receiver (part of the radio interface 132 communicating with the mobile unit 20) along a predetermined path in accordance with the anticipated motion of the mobile unit 20, receiving the received signal at the receiver, and wirelessly transmitting the transmit signal from a transmitter (part of the radio interface 132 communicating with the fixed radio port 50) connected to the receiver. The motion of the mobile unit 20 is independent of the motion of the receiver (e.g. radio interface 132). (See generally FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 103

Claim 103 is directed to a method of providing a communication connection between a communication network and a plurality of mobile units having a motion relative to a plurality of fixed ports. The plurality of fixed ports are communicatively coupled to the communication network. The method comprises the steps of establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of fixed ports through a movable base station having a motion in accordance with the motion of the mobile units and simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports. (See generally FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 113

Claim 113 is directed to a communication system comprising a first transceiver (e.g. the radio interface 132 communicating with the mobile unit 20) and a second transceiver (e.g. the radio interface 132 communicating with the fixed radio ports 50). The first transceiver is configured to provide a moving communication cell to a mobile unit 20 while the moving communication cell has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit 20. The second transceiver is connected to the first transceiver and is configured to wirelessly exchange signals, corresponding to the communication cell, with at least one fixed port 50. The actual motion of the mobile unit 20 is independent of the motion of the moving communication cell. The movable base station 30, therefore provides a moving communication cell in the exemplary embodiment presented in the application. (See generally FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 114

Claim 114 depends from claim 113 and is further directed to a communication system where the predetermined path has a contour corresponding to a roadway contour of a roadway and the anticipated motion of the mobile unit is along the roadway 10, 15. (See FIG. 1 and page 5, lines 5-9).

Claim 116

Claim 116 depends from claim 115 and is further directed to a communication system that further comprises a plurality of fixed ports 50 disposed along the anticipated path of the

mobile unit 20. The plurality of fixed ports 50 are in communication with the moving base station 30. (See generally FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 119

Claim 119 is directed to a method of providing communication services to a mobile unit 20. The method comprises providing a moving communication cell to a mobile unit 20 while the moving communication cell has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit 20 and wirelessly exchanging signals with at least one fixed port corresponding to the communication cell. The actual motion of the mobile unit 20 is independent of the motion of the cell. (See generally FIG. 1 and page 5, line 5 through page 6, line 21).

Claim 120

Claim 120 depends from claim 119 and is further directed to a method where the predetermined path has a contour corresponding to a roadway contour of a roadway and the anticipated motion of the mobile unit is along the roadway 10, 15. (See FIG. 1 and page 5, lines 5-9).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Appellant wishes the Board of Patent Appeals and Interferences to review the following issues on appeal:

1) Whether the rejection of any of claims 30-36, 49, 54-62, 89-96, 93, 103-106 and 113-123 under 35 U.S.C. §102(b) as being anticipated by Yokoi et al. (US 5,282,239) ("Yokoi") was proper.

ARGUMENT

Appellant respectfully submits that claims 30-36, 49, 54-62, 83-89, 93,103,107,113,118 and 119 are allowable over the art cited by the Examiner. Each of the issues presented for review are addressed below.

102(b) Rejection - Yokoi

Claims 30-36, 49, 54-62, 89-96, 93,103-106 and 113-123 stand rejected under 35 U.S.C. 102(b) as being anticipated by Yokoi et al (US 5,282,239) ("Yokoi"). Appellant respectfully submits that these claims are allowable over the art cited. The claims are argued separately as indicated by the headings

Applicants respectfully submit that the claims as presented are allowable over the art cited by the examiner. A rejection of a claim for anticipation requires that a single anticipating reference include, within its four corners, all of the elements, limitations, and relationships therebetween of the rejected claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Applicants respectfully submit that each and every element recited in any one of the claims is not found in Yokoi.

Claim 30

Claim 30 as amended recites an apparatus comprising "a receiver configured to wirelessly receive a received signal" and a "transmitter configured to transmit a transmit signal corresponding to the received signal to a mobile unit while the transmitter has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, wherein an actual motion of the mobile unit is independent of the motion of the transmitter." Appellant respectfully submits that Yokoi does not teach all of the limitations of this claim. For example, Yokoi does not teach an apparatus that comprises a receiver that wirelessly receives a received signal and transmits a corresponding transmit signal to a mobile unit. In Yokoi, "all of the base stations 4 are coupled by wires to a central switch 5". (Yokoi, Column 2, lines 59-60). Further, the "moving conveyance base station 10 is coupled to the central switch 5 by wires running parallel to the elevator cable that supports the elevator 1". (Yokoi, Column 4, lines 42-45). "The central switch 5 is coupled via wires to the moving conveyance base stations 20, 32, 35. It is also coupled via wires to fixed base stations . . ." (Yokoi, Column 6, lines 21-23). Any signals transmitted from the moving conveyance base station (10, 20, 32, or 35) in Yokoi do not correspond to wirelessly received signals. The moving base station in Yokoi transmits signals to a portable cordless telephone 19 where the transmitted signals correspond to signals received from the central switch 5 through wires and not received wirelessly.

In the last Office Action, the Examiner attempted to apply the components of the elevator embodiment of Yokoi to the elements of claim 30 for support that claim 30 was anticipated by Yokoi. Appellant respectfully submits that it is clear after careful examination that Yokoi does not show all of the elements of claim 30. As applied by the Examiner, the "receiver" of claim 30 is intended to read on the "fixed base station" of Yokoi and the "fixed port" of claim 30 is intended to read on the "central switch" of Yokoi. Therefore, in order for claim 30 to read on Yokoi, the fixed base station must "wirelessly receive a received signal" from the central switch 5. This is not the case in Yokoi. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23).Therefore, any signal received at the fixed base station **from the central switch 5** is received through a wire and not "wirelessly" as recited in claim 30. The Examiner cites to column 3, lines 55-65 and column 8, lines 5-15 for support that signals are wirelessly received at the central switch 5. At column 3, lines 55-66, Yokoi explains that the portable cordless telephone can communicate through a fixed based station connected to the central switch. Therefore, signals wirelessly received at the fixed base station are received **from the portable telephone 6** and **not** from the central switch 5. At column 8 lines 5-15, Yokoi discusses hand-offs of a portable cordless telephone from a moving–conveyance station to a fixed base station. There is nothing in this section of Yokoi to suggest that the moving conveyance station is transmitting signals that correspond to wirelessly received signals.

Appellant respectfully submits that Yokoi does not suggest to transmit signals from a moving base station that correspond to wirelessly received signals from a fixed port. Accordingly, Yokoi does not show or describe an apparatus comprising a "receiver configured to wirelessly receive a received signal" and "a transmitter configured to transmit a transmit signal corresponding to the received signal to a mobile unit while the transmitter has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, wherein an actual motion of the mobile unit is independent of the motion of the transmitter." Therefore, Yokoi does not describe or show all of the elements of claim 30 and claim 30 is allowable.

Claims 31 and 32

Appellant respectfully submits that Yokoi does not describe all of the elements of claim 31. In addition to the elements not shown in the base claim 30, claim 31 recites elements not described Yokoi. Claim 31 recites "an apparatus in accordance with claim 30 wherein the

predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway." Appellants submit that Yokoi does not describe this limitation. In the crane embodiment of Yokoi, several cranes move along parallel tracks in a factory. Moving-conveyance base stations are mounted on the cranes to provide communications to the portable telephones used by crane operators. Any anticipated motion of the portable telephone is along a track and not a roadway. Yokoi does not suggest that the factory system can be applied to a roadway. In expanding the description to more than elevators and cranes, Yokoi specifically states that the invention may be applied to any type of moving conveyance installed in a building. Accordingly, teaches away from applying the system to a roadway.

Claim 33

Appellant respectfully submits that Yokoi does not describe all of the elements of claim 33. In addition to the elements not shown in the base claim 30, claim 33 recites elements not described Yokoi. Claim 33 recites "an apparatus in accordance with claim 32, wherein the received signal is received from a fixed radio port". Appellant submits Yokoi does not describe receiving the received signal form a fixed radio port. Signals transmitted by the moving conveyance base station correspond to signals received from the central switch 5. A central switch is not a fixed radio port. As described in the appellant's application at page 7, lines 22-23, fixed radio ports 50 include a radio interface circuit 154 providing an interface between the radio signals received through the antennas 110, 111 and a processor 150. The fixed radio ports, therefore, include a radio circuit. The central switch in Yokoi does not include radio circuitry. The central switch exchanges signals with the base stations using wires and not radios. An attempt to read "fixed radio ports" on to a fixed base station of Yokoi also fails since the moving conveyance stations do not exchange signals with the fixed base stations.

Claim 34

Appellant respectfully submits that Yokoi does not describe every element of claim 34. Claim 34 recites an apparatus comprising "a receiver configured to receive a received signal from a mobile unit while the receiver has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, wherein an actual motion of the mobile unit is independent of the motion of the receiver; and a transmitter configured to wirelessly transmit a transmit signal corresponding to the received signal to at least one fixed port." Appellant respectfully submits that Yokoi does not teach all of the limitations of this claim.

Yokoi does not teach an apparatus that comprises a transmitter that wirelessly transmits a transmit signal corresponding to a received signal to at least one port. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23). In Yokoi, signals transmitted from the moving-conveyance base station that correspond to signals received from the portable telephones are transmitted through wires to the central switch and are not "wirelessly" transmitted as claimed. The moving conveyance base station in Yokoi only wirelessly transmits signals to portable cordless telephones and not to fixed radio ports.

Claims 35 and 36

Appellant respectfully submits that Yokoi does not describe all of the elements of claim 35. In addition to the elements not shown in the base claim 34, claim 35 recites elements not described Yokoi. Claim 35 recites "an apparatus in accordance with claim 34 wherein the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway." Appellants submit that Yokoi does not describe this limitation. In the crane embodiment of Yokoi, several cranes move along parallel tracks in a factory. (Yokoi, Column 8, lines 16-35). Moving-conveyance base stations are mounted on the cranes to provide communications to the portable telephones used by crane operators. Any anticipated motion of the portable telephone is along a track and not a roadway. As discussed above, Yokoi does not suggest that the factory system can be applied to a roadway.

Claim 49

Appellant respectfully submits that Yokoi does not describe every element of claim 49. Claim 49 recites "a movable base station configured to establish a communication link between a fixed port and mobile unit while the movable base station has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, the communication link comprising a wireless communication link between the movable base station and the fixed port, wherein an actual motion of the mobile unit is independent of the motion of the movable base station". Appellant respectfully submits that Yokoi does not describe a movable base station configured to establish a communication link between a fixed port and a mobile unit where the communication link comprises a wireless communication link. The moving conveyance base station in Yokoi communicates to a central switch through a wire. Accordingly, the communication link between the moving conveyance base station and the central switch

does not comprise a wireless communication link. In the Final Office Action, the Examiner proposed that "fixed port" in claim 49 reads on the fixed base station in Yokoi. (Final Office Action, Page 6, line 19.) There is no communication link between the moving conveyance base station and the fixed base station, however. In Yokoi, the portable telephones communicate with fixed base stations or with the moving conveyance base stations. The moving conveyance base stations, however, do not communicate with the fixed base station and are connected to the central switch through wires. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23). At page 6, line 19 of the Final Office Action, the Examiner also cited to column 8, lines 5-15 of Yokoi. This section in Yokoi indicates that the portable telephone can be handed off between base stations. There is no suggestion, however, that the moving conveyance base stations can communicate with the fixed base stations. Accordingly, appellants respectfully submit that Yokoi does not disclose a wireless communication link between a moving base station and a fixed port and that claim 49 is allowable.

Claim 54

Appellants respectfully submit that Yokoi does not describe all of the limitations of claim 54. Claim 54 recites a movable base station configured to move relative to a fixed port and comprises "a second radio interface configured to establish a second wireless communication link between the movable base station and the fixed port". Yokoi does not describe a movable base station with this element. The moving conveyance base station in Yokoi includes radio circuitry for communicating only with a portable telephone and not any fixed port. The moving conveyance base station is connected to the central switch with wires and does not use a wireless communication link to communicate with the central switch or the fixed base stations. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23). Accordingly, appellants respectfully submit that Yokoi does not describe all of the limitations of claim 54 and that claim 54 is allowable.

Claim 61 and 62

Appellant respectfully submits that Yokoi does not describe all of the elements of claim 61. In addition to the elements not shown in the base claim 54, claim 61 recites elements not described in Yokoi. Claim 61 recites "a movable base station in accordance with claim 54

wherein the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway." Appellants submit that Yokoi does not describe this limitation. In the crane embodiment of Yokoi, several cranes move along parallel tracks in a factory. Moving-conveyance base stations are mounted on the cranes to provide communications to the portable telephones used by crane operators. Any anticipated motion of the portable telephone is along a track and not a roadway. As discussed above, Yokoi does not suggest that the factory system can be applied to a roadway.

Claim 89

Appellant respectfully submits that Yokoi does not teach all of the steps of claim 89. Claim 89 as amended recites a method where a motion of a transmitter is controlled "along a predetermined path in accordance with the anticipated motion of the mobile unit, wherein the motion of the mobile unit is independent of the motion of the transmitter" and comprises the steps of:

"wirelessly receiving a received signal;

controlling a motion of a transmitter along a predetermined path in accordance with the anticipated motion of the mobile unit, wherein the motion of the mobile unit is independent of the motion of the transmitter; and

transmitting a transmit signal corresponding to the received signal to the mobile unit."

Appellant respectfully submits that Yokoi does not teach these three steps. Yokoi does not teach "wirelessly receiving a received signal" and "transmitting a transmit signal corresponding to the received signal to the mobile unit". Signals transmitted to the portable telephones in Yokoi correspond to signals received through wires at the moving conveyance base station and are not wirelessly received. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23). Any signals received from the base station in Yokoi do not correspond to wirelessly received signals. The moving conveyance base station in Yokoi transmits signals to a portable cordless telephone where the transmitted signals correspond to signals received from the central switch through wires and not received wirelessly.

Continuing with claim 89, appellants respectfully submit that Yokoi does not describe "controlling a motion of a transmitter along a predetermined path in accordance with the

anticipated motion of the mobile unit, wherein the motion of the mobile unit is independent of the motion of the transmitter" as recited in claim 89. The moving conveyance base station in Yokoi moves in accordance with the user operating instructions within the elevator 31 and is not based on the anticipated motion of the portable telephone 19. In applying Yokoi, the Examiner references the moving conveyance base station 32 in an elevator 31 that provides service to a portable telephone 19 in an adjacent elevator 1. The moving conveyance base station 32 is controlled by users within the first elevator 31 and is not "in accordance with the anticipated motion" of the portable telephone 19 in the adjacent elevator 1. Since the moving conveyance station 32 in mounted in the elevator 31, its motion is controlled by the motion of the elevator. There is nothing in Yokoi to suggest that the elevator 31 is controlled to move based on the motion of the adjacent elevator 1 in which the portable telephone 19 is contained.

Claim 93

Appellant respectfully submits that Yokoi does not teach all of the steps of claim 93. Claim 93 recites a method of wirelessly transmitting a transmit signal corresponding to a received signal transmitted from a mobile unit where the method comprises the steps of:

"controlling a motion of a receiver along a predetermined path in accordance with the anticipated motion of the mobile unit, wherein the motion of the mobile unit is independent of the motion of the receiver";

receiving the received signal at the receiver; and

wirelessly transmitting the transmit signal from a transmitter connected to the receiver".

Appellant respectfully submits that Yokoi does not teach these three steps. Yokoi does not teach "wirelessly transmitting the transmit signal from a transmitter connected to the receiver" where the transmit signal corresponds to the received signal received from a mobile unit. Any signals wirelessly transmitted from the moving conveyance base station in Yokoi are transmitted to the portable telephones and do not correspond to signals received from the portable telephones. Signals corresponding to signals received from the portable telephones are sent through wires to the central switch and are not wirelessly transmitted. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23). Any signals wirelessly transmitted from the base station in Yokoi do not correspond to signals received from the portable telephones.

Continuing with claim 93, appellants respectfully submit that Yokoi does not describe "controlling a motion of a receiver along a predetermined path in accordance with the anticipated motion of the mobile unit, wherein the motion of the mobile unit is independent of the motion of the receiver" as recited in claim 93. The moving conveyance base station in Yokoi moves in accordance with the user operating instructions within the elevator 31 and is not based on the anticipated motion of the portable telephone 19. In applying Yokoi, the Examiner references the moving conveyance base station 32 in an elevator 31 that provides service to a portable telephone 19 in an adjacent elevator 1. The moving conveyance base station 32 is controlled by users with the first elevator 31 and is not "in accordance with the anticipated motion" of the portable telephone 19 in the adjacent elevator 1. Since the moving conveyance station 32 in mounted in the elevator 31, its motion is controlled by the motion of the elevator 31. There is nothing in Yokoi to suggest that the elevator 31 is controlled to move based on the motion of the adjacent elevator 1 in which the portable telephone 19 is contained.

Claim 103

Appellant respectfully submits that Yokoi does not teach all of the steps of claim 103. Claim 103 recites a method comprising the step of "establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of fixed ports through a movable base station having a motion in accordance with the motion of the mobile units." Appellant respectfully submits that Yokoi does not teach this limitation. The moving conveyance base station in Yokoi is connected to a central switch and does not communicate with a fixed port. A central switch is not a fixed radio port. As described in the appellant's application, fixed radio ports 50 include a radio interface circuit 154 providing an interface between the radio signals received through the antennas 110 111 and a processor 150. (Application, page 7, lines 22-23). The fixed radio port, therefore, includes a radio circuit. The central switch in Yokoi does not include radio circuitry. The central switch exchanges signals with the base stations using wires and not radios. Further, the fixed base station can not be interpreted as a fixed port since the moving conveyance base station does not communicate with the fixed base station.

Further, claim 103 recites the step of "simultaneously handing off the plurality of mobile units to a second fixed port of the plurality of ports." Appellant respectfully submits that Yokoi does not teach this step. Nowhere in Yokoi is a showing that a plurality of mobile units are handed off simultaneously. Each portable cordless telephone in Yokoi is handed off individually based on the quality of its communication link. (Yokoi, Col. 7, lines 57-61). Each portable cordless telephone can be handed off between the fixed base station 4 and moving-conveyance

base station 10, between two moving conveyance base stations 10, or between two fixed base stations 4. In claim 103, the moving base station establishes wireless communication links between the mobile units and the moving base station and between the moving base station and a fixed port. The moving base station of claim 103 simultaneously hands off the plurality of mobile stations from one fixed port to another by establishing a communication link with the other fixed port. In contrast, several mobile units in Yokoi can not be handed off from one fixed port to another, simultaneously. As presented above, the portable cordless telephones do not communicate to a fixed port **through** a moving base station. The moving conveyance stations do not communicate with the fixed base stations in Yokoi. Appellants respectfully submit that Yokoi does not show all of the elements of claim 103 and that that this claim is allowable.

Claims 113 and 117

Claim 113 recites a communication system comprising a first transceiver configured to provide a communication cell and "a second transceiver connected to the first transceiver and configured to wirelessly exchange signals with at least one fixed port corresponding to the communication cell." Appellant respectfully submits that Yokoi does not teach this limitation. The moving-conveyance station is connected to the central switch through wires. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23). Appellant respectfully submits that Yokoi does not show all of the elements of claim 113 and that this claim is allowable.

Claims 114 and 115

Appellant respectfully submits that Yokoi does not describe all of the elements of claim 114. In addition to the elements not shown in the base claim 113, claim 114 recites elements not described Yokoi. Claim 114 recites "a communication system in accordance with claim 113 wherein the predetermined path has a contour corresponding to a roadway contour of a roadway and the anticipated motion of the mobile unit is along the roadway." Appellants submit that Yokoi does not describe this limitation. In the crane embodiment of Yokoi, several cranes move along parallel tracks in a factory. Moving-conveyance base stations are mounted on the cranes to provide communications to the portable telephones used by crane operators. Any anticipated motion of the portable telephone is along a track and not a roadway. As discussed above, Yokoi does not suggest that the factory system can be applied to a roadway.

Claims 116 and 117

Appellant respectfully submits that Yokoi does not describe all of the elements of claim 116. In addition to the elements not shown in the base claim 113, claim 116 recites elements not described Yokoi. Claim 116 recites "a communication system in accordance with claim 115, further comprising a plurality of fixed ports disposed along the anticipated path of the mobile unit, the plurality of fixed ports in communication with the moving base station". Yokoi does not suggest that a plurality of fixed ports are disposed along the anticipated path of a mobile unit. There is no suggestion in Yokoi that either the fixed base stations or a plurality of central switches are placed along the tracks of the crane embodiment or along the elevator shafts in the elevator embodiment. Only a single central switch is discussed and there is no discussion regarding its position relative to the tracks or elevator shafts. Further, there is no discussion of the position of the fixed base stations relative to the tracks or the elevator shafts. In addition, the fixed ports can not be interpreted to be fixed ports since the moving conveyance stations do not communicate with the fixed base stations as presented above.

Claim 119

Appellant respectfully submits that Yokoi does not teach all of the steps of claim 119. Claim 119 recites a method where "wirelessly exchanging signals with at least one fixed port corresponding to the communication cell." Appellant respectfully submits that Yokoi does not teach this limitation of this claim. The moving conveyance station in Yokoi is connected to the central switch through wires. As explained above, Yokoi explicitly states that the moving conveyance base stations and the fixed base stations are connected to the central switch 5 by wires. (Column 2, lines 59-60, Column 4, lines 42-45 and Column 6, lines 21-23). Further, Yokoi does not discuss communicating with the fixed base stations to provide a moving communication cell. Appellant respectfully submits that Yokoi does not show all of the elements of claim 119 and that this claim is allowable.

Claims 120, 121, 122 and 123

Appellant respectfully submits that Yokoi does not describe all of the elements of claim 120. In addition to the steps not shown in the base claim 119, claim 120 recites limitations not described Yokoi. Claim 120 recites "a method in accordance with claim 119, wherein the predetermined path has a contour corresponding to a roadway contour of a roadway and the anticipated motion of the mobile unit is along the roadway." Appellants submit that Yokoi does not describe this limitation. In the crane embodiment of Yokoi, several cranes move along

parallel tracks in a factory. Moving-conveyance base stations are mounted on the cranes to provide communications to the portable telephones used by crane operators. Any anticipated motion of the portable telephone is along a track and not a roadway. Yokoi does not suggest that the factory system can be applied to a roadway.

Conclusion

Appellant respectfully submits that the pending claims are allowable, that the case is in a condition for allowance, and that the grounds of rejection should be reversed.

Respectfully submitted,

Date: May 12, 2006

By: _____

Charles D. Gavrilovich, Jr.
Reg. No. 41,031

Charles D. Gavrilovich, Jr.
Gavrilovich, Dodd, & Lindsey, LLP
985 Paseo La Cresta, Suite B
Chula Vista, CA 91910
Phone: 619 271 0382
FAX: 619 271 0383

APPENDIX

Claims At Issue On Appeal

30. An apparatus comprising:

a receiver configured to wirelessly receive a received signal; and

a transmitter configured to transmit a transmit signal corresponding to the received signal to a mobile unit while the transmitter has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, wherein an actual motion of the mobile unit is independent of the motion of the transmitter.

31. An apparatus in accordance with claim 30 wherein the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway.

32. An apparatus in accordance with claim 31, wherein the transmitter is further configured to travel on a conveyor device along the predetermined path.

33. An apparatus in accordance with claim 32, wherein the received signal is received from a fixed radio port.

34. An apparatus comprising:

a receiver configured to receive a received signal from a mobile unit while the receiver has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, wherein an actual motion of the mobile unit is independent of the motion of the receiver; and

a transmitter configured to wirelessly transmit a transmit signal corresponding to the received signal to at least one fixed port.

35. An apparatus in accordance with claim 34 wherein the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway.

36. An apparatus in accordance with claim 35, wherein the receiver is further configured to travel on a conveyor device along the predetermined path.

49. A movable base station configured to establish a communication link between a fixed port and mobile unit while the movable base station has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, the communication link comprising a wireless communication link between the movable base station and the fixed port, wherein an actual motion of the mobile unit is independent of the motion of the movable base station.

54. A movable base station configured to have a motion relative to a fixed port along a predetermined path and in accordance with an anticipated motion of a mobile unit, comprising:

a first radio interface configured to establish a first wireless communication link between the movable base station and the mobile unit; and

a second radio interface configured to establish a second wireless communication link between the movable base station and the fixed port, wherein an actual motion of the mobile unit is independent of the motion of the movable base station.

61. A movable base station in accordance with claim 54, wherein the predetermined path has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway.

62. A movable base station in accordance with claim 61, wherein the movable base station is further adapted to travel on a conveyor device along the predetermined path.

89. A method of transmitting a signal to a mobile unit having an anticipated motion relative to Earth, the method comprising the steps of:

wirelessly receiving a received signal;

controlling a motion of a transmitter along a predetermined path in accordance with the anticipated motion of the mobile unit, wherein the motion of the mobile unit is independent of the motion of the transmitter; and

transmitting a transmit signal corresponding to the received signal to the mobile unit.

93. A method of wirelessly transmitting a transmit signal corresponding to a received signal transmitted from a mobile unit having an anticipated motion relative to Earth, the method comprising the steps of:

controlling a motion of a receiver along a predetermined path in accordance with the anticipated motion of the mobile unit, wherein the motion of the mobile unit is independent of the motion of the receiver;

receiving the received signal at the receiver; and

wirelessly transmitting the transmit signal from a transmitter connected to the receiver.

103. A method of providing a communication connection between a communication network and a plurality of mobile units having a motion relative to a plurality of fixed ports, wherein the plurality of fixed ports are communicatively coupled to the communication network, the method comprising the steps of:

establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of fixed ports through a movable base station having a motion in accordance with the motion of the mobile units; and

simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports.

113. A communication system comprising:

a first transceiver configured to provide a moving communication cell to a mobile unit while the moving communication cell has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, wherein an actual motion of the mobile unit is independent of the motion of the moving communication cell; and

a second transceiver connected to the first transceiver and configured to wirelessly exchange signals with at least one fixed port corresponding to the communication cell.

114. A communication system in accordance with claim 113 wherein the predetermined path has a contour corresponding to a roadway contour of a roadway and the anticipated motion of the mobile unit is along the roadway.

115. A communication system in accordance with claim 114, comprising a moving base station adapted to provide the moving communication cell.

116. A communication system in accordance with claim 115, further comprising a plurality of fixed ports disposed along the anticipated path of the mobile unit, the plurality of fixed ports in communication with the moving base station.

117. A communication system in accordance with claim 116, further comprising a gateway connected to the plurality of fixed ports.

119. A method of providing communication services to a mobile unit, the method comprising:

providing a moving communication cell to a mobile unit while the moving communication cell has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit, wherein an actual motion of the mobile unit is independent of the motion of the cell; and

wirelessly exchanging signals with at least one fixed port corresponding to the communication cell.

120. A method in accordance with claim 119, wherein the predetermined path has a contour corresponding to a roadway contour of a roadway and the anticipated motion of the mobile unit is along the roadway.

121. A method in accordance with claim 120, wherein the providing the moving communication cell comprises:

providing the moving communication cell from a moving base station.

122. A method in accordance with claim 121, wherein the providing the moving communication cell comprises:

exchanging fixed port signals between the moving base station and at least one fixed port of a plurality of fixed ports disposed along the anticipated path of the mobile unit.

123. A method in accordance with claim 122, wherein the providing the moving communication cell further comprises:

exchanging mobile unit signals between the moving base station and the mobile unit, the fixed port signals corresponding to the mobile unit signals.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/401,584	09/22/1999	CHARLES D. GAVRILOVICH	GAVRILOVICH-	4845

35083 7590 10/03/2005

CHARLES D. GAVRILOVICH, JR.,
GAVRILOVICH, DODD & LINDSEY, LLP
985 PASEO LA CRESTA, SUITE B
CHULA VISTA, CA 91910-6729

EXAMINER	
CONTEE, JOY KIMBERLY	
ART UNIT	**PAPER NUMBER**
2686	

DATE MAILED: 10/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/401,584	GAVRILOVICH, CHARLES D.	
	Examiner	Art Unit	
	Joy K Contee	2686	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 March 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *30-36,49-82,89-106 and 113-123* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *63-82 and 97-102* is/are allowed.

6)☒ Claim(s) *30-36,49-62,89-96,103-106 and 113-123* is/are rejected.

7)☒ Claim(s) *118* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 3/28/2005 have been fully considered but they are not persuasive.

Applicant argues that Yokoi et al., US Patent No. 5,282,239 does not teach an apparatus that comprises a receiver that wirelessly receives a received signal and transmits a corresponding transmit signal to a mobile unit. Applicant also suggests that Yokoi et al. does not disclose wherein the communication link comprising a wireless communication link between the movable base station and fixed port. Applicant has added similar limitations to claims 30,34,49,54,89 and 93. As discussed below, Yokoi et al. further anticipates a fixed base station for wirelessly transmitting and receiving with a mobile unit and movable base station (see col. 3,lines 55-59 and col. 8,lines 5-16).

Applicant also argues that Yokoi et al. fails to disclose "simultaneously handing off the plurality of mobile units to a second fixed port of the plurality of ports" and that Yokoi et al. cordless phone does not communicate to a fixed port through a moving base station. Examiner disagrees. Yokoi et al. teaches that hand-off request signals can also be used to hand-off calls from a moving conveyance base station to a fixed bse station when the person using the portable cordless phone leaves the elevator (see col. 8,lines 5-15 and see Fig. 11. Further Yokoi et al. teaches that calls can be made simultaneously in all three elevators without mutual interference or crosstalk, thus given the example in Fig. 12, as long as the adjacent elevators remain together handoff will occur simultaneously amongst the three elevators.

Specification

2. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: Claim 118 recites "a moving base station comprising the first transceiver and the second transceiver". This limitation is not found in the disclosure.

Claim Objections

3. Claim 118 is objected to because of the following informalities: "a moving base station comprising the first transceiver and the second transceiver" is not found in the specification. Appropriate correction is required. This portion of the limitation has not been treated on the merits.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 30-36,49, 54, 58, 61, 62, 89, 93,103 and 113-123 are rejected under 35 U.S.C. 102(b) as being anticipated by Yokoi (US 5,282,239), previously used, different embodiment.

Regarding claims 30,113 and 119, Yokoi teaches an apparatus comprising:

a receiver ***(i.e., reads on fixed base station)*** configured to wirelessly receive a receive signal (and a second transceiver **(reads on movable base station)** connected to a first transceiver **(reads on fixed base station)** and configured to wirelessly exchange signals with at least one fixed port **(i.e., reads on central switch)** corresponding to the communication cell) (col. 3, lines 55-65 and col. 8,lines 5-15); and

a transmitter/ moving communication cell ***(i.e., reads on moving base station 32, see Fig. 12)*** (and method of providing a moving communication cell to a mobile unit) adapted to transmit a signal to a mobile unit ***(i.e., reads on portable cordless telephone 19, see Fig. 12)*** while the transmitter/moving communication cell ***(i.e., moving base station 32)*** has a motion relative to Earth along a predetermined path ***(i.e., moving base station 32 is coupled to an elevator 31, see Fig. 12, which moves relative to earth along the elevator shaft in a vertical direction, i.e., upward and downward)*** and in accordance with an anticipated motion of the mobile unit ***(i.e., reads on a person carries the portable cordless telephone 19 and moves relative to both moving base stations 20 and 32, see Fig. 12 and the earth)***, wherein an actual motion of the mobile unit ***(i.e., reads on portable cordless telephone 19)*** is independent of the motion ***(i.e., portable cordless telephone 19 moves within and with moving base station 20 coupled to the elevator 1, however, said portable cordless telephone moves free, i.e., said cordless telephone's motion is not due to the motion of elevator 31, which is adapted to transmit a signal to said cordless telephone when elevators 1 and 31 are moving side by side, i.e., reads***

on "anticipated motion" of mobile) of the transmitter/moving communication cell ***(i.e., reads on moving base station 32)*** (col. 7,lines 39-52 and col. 8,lines 5-15).

Regarding claim 89, the claim is rejected as being anticipated by Yokoi for the same reason as claim 30 above.

Regarding claims 31,114 and 120, Yokoi teaches wherein the predetermined path (i.e., parallel track is the path) has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway (col. 8, lines 24-34).

Regarding claim 32, Yokoi teaches a wherein the transmitter is further adapted to travel on a conveyor device along the predetermined path (col. 7, lines 21-38, col. 8, lines 24-34).

Regarding claim 33, Yokoi teaches wherein the signal corresponds to a received signal received at the transmitter from a fixed radio port (i.e., sending a call via the moving base, col. 8,lines 5-15).

Regarding claim 34, Yokoi teaches a receiver ***(i.e., within moving base station 32)*** adapted to receive a signal from a mobile unit ***(i.e., portable cordless telephone 19)*** while the receiver ***(i.e., moving base station 32)*** has a motion relative to Earth along a predetermined path ***(i.e., moving base station 32 is coupled to elevator 31, which moves relative to earth)*** and in accordance with an anticipated motion of the mobile unit ***(i.e., reads on a person carries the portable cordless telephone 19 and moves relative to both moving base stations 20 and 32, see Fig. 12 and the earth)***,wherein an actual motion of the mobile unit ***(i.e., with and within elevator 1)*** is independent ***(i.e., portable cordless telephone is free from elevator 31)*** of the

motion of the receiver ***(moving base station 32)*** (col. 7,lines 39-52 and col. 8,lines 5-15); and transmitter **(reads on movable base station)** configured to wirelessly exchange signals with at least one fixed port **(i.e., reads on central switch)** corresponding to the communication cell) (col. 3, lines 55-65 and col. 8,lines 5-15);

Regarding claim 93, the claim is rejected as being anticipated by Yokoi for the same reason as claim 34 above.

Regarding claim 35, Yokoi teaches wherein the predetermined path (i.e., parallel track is the path) has a contour corresponding to a roadway contour and the anticipated motion of the mobile unit is on the roadway (col. 8, lines 24-34).

Regarding claim 36, Yokoi teaches a wherein the transmitter is further adapted to travel on a conveyor device along the predetermined path (col. 7, lines 21-38, col. 8, lines 24-34).

Regarding claim 49, Yokoi teaches a movable base station (20 or 32) adapted to establish a communication link between a fixed port and mobile unit (19) while the movable base station has a motion relative to Earth along a predetermined path and in accordance with an anticipated motion of the mobile unit ***(i.e., reads on a person using the portable cordless telephone leaves the elevator 1)***, the communication link comprising a wireless communication link between the movable base station and the fixed port **(i.e., reads on fixed base station) (col. 8,lines 5-15)** wherein the motion of the movable base station is controlled independently to the anticipated motion of the mobile unit ***(i.e., portable cordless telephone 19 moves within and with moving base station 20 coupled to the elevator 1, however, said portable cordless***

telephone moves free, i.e., said cordless telephone's motion is not due to the motion of elevator 31, which is adapted to transmit a signal to said cordless telephone when elevators 1 and 31 are moving side by side, i.e., reads on "anticipated motion" of mobile) (col. 7,lines 39-52 and col. 8,lines 5-15).

Regarding claims 54,115-118,121-123, Yokoi teaches a movable base station (or moving communication cell) (32) adapted to have a motion relative to a fixed port (fixed base) along a predetermined path and in accordance with an anticipated motion of a mobile unit, comprising: a first radio interface (or gateway) adapted to establish wirelessly a first communication link between the movable base station and the mobile unit (col. 7, lines 39-52); and a second radio interface adapted to establish wirelessly a second communication link between the movable base station and the fixed port wherein an actual motion of the mobile unit independent of the motion of the movable base station ***(i.e., portable cordless telephone 19 moves within and with moving base station 20 coupled to the elevator 1, however, said portable cordless telephone moves free, i.e., said cordless telephone's motion is not due to the motion of elevator 31, which is adapted to transmit a signal to said cordless telephone when elevators 1 and 31 are moving side by side, i.e., reads on "anticipated motion" of mobile)*** (col. 7,lines 39-52 and col. 8,lines 5-15).

Regarding claim 61,dependent on claim 54, Yokoi teaches a wherein the transmitter is further adapted to travel on a conveyor device along the predetermined path (col. 7, lines 21-38, col. 8, lines 24-34).

Regarding claim 62,depedent on claim 61, Yokoi teaches wherein the signal corresponds to a received signal received at the transmitter from a fixed radio port (i.e., sending a call via the moving base, col. 4, lines 6, lines 46-55).

Regarding claim 103, Yokoi teaches a method of providing a communication connection between a communication network and a plurality of mobile units (i.e., reads on 20,32 and 35, see Fig. 11) having a motion relative to a plurality of fixed ports (such as fixed base 4), wherein the plurality of fixed ports are communicatively coupled to the communication network, the method comprising the steps of: establishing a first communication link between the plurality of mobile units (i.e., reads on moving base stations 20,32 and 35, see Fig. 11) and a first fixed port of the plurality of fixed ports through a movable base station having a motion in accordance with the motion of the mobile units station ***(i.e., portable cordless telephone 19 moves within and with moving base station 20 coupled to the elevator 1, however, said portable cordless telephone moves free, i.e., said cordless telephone's motion is not due to the motion of elevator 31, which is adapted to transmit a signal to said cordless telephone when elevators 1 and 31 are moving side by side, i.e., reads on "anticipated motion" of mobile)***; and simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports (col. 8, line5-15).

Allowable Subject Matter

6. Claims 63-82 and 97-102 are allowed.

7. Claims 50-53,55-60,90-92, 94-96 and 104-106 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in

independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joy K Contee whose telephone number is 571-272-7906. The examiner can normally be reached on Monday thru Friday, 5:30 am. until 2:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha Banks-Harold can be reached on 571-272-7905. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JKC

JAY K. CONTEE
PATENT EXAMINER

Marsha D Banks-Harold

MARSHA D. BANKS-HAROLD
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION

BACKGROUND OF THE INVENTION

Related Applications

This application is a continuation of U.S. Application Serial No. 08/953,962, filed October 20, 1997, which is a continuation of U.S. Application Serial No. 08/687,722, filed July 26, 1996, now U.S. Patent 5,729,826, which is a national phase application of PCT/US95/07037, filed June 2, 1995.

Field of the Invention

The invention relates to cellular telephone systems in which a mobile unit communicates by wireless communication to a base station connected to the wire telephone network and more particularly to cellular telephone systems adapted for use with fast-moving mobile units.

Background Art

In a typical cellular telephone system, an area is divided into a plurality of cells with each cell having a centrally located cell site. A mobile unit moving in such a cellular network communicates by radio with a nearest cell site. The cell sites are each connected by cable or point-to-point microwave to a telephone network interface. The network interface typically provides communication among cell sites and between the cell sites and the so-called wire line telephone network. The functions of a typical network interface are described in The Bell System Technical Journal, January 1979, Volume 58, No. 1. One of the functions to be performed by the telephone network interface is the so-called "handoff" function. As a mobile unit moves through a cellular network, it will move away from one cell site and toward another cell site. Each cell site monitors signal quality of the signal received from the mobile unit and passes information to the telephone network interface and determines when a call in progress is to be transferred from one cell site to another. This procedure is known as "handoff". The handoff process involves several operations including selecting a cell site trunk between the MTSO and the new cell site, sending a message to the mobile unit transmitter/receiver to tune

from its present voice channel to a voice channel in the new cell site corresponding to the newly selected trunk, setting up a talking path in the MTSO from the cell site trunk to the trunk of the telephone network presently in use in the call, and idling the talking path in the switching network in the MTSO between the old cell trunk and the telephone network trunk assigned to the call.

A problem with existing mobile telephone systems is the considerable time required in handoffs. This becomes a particular problem in urban areas which are highly congested. A basic principle of cellular telephone systems is the concept of frequency reuse. It can be shown that traffic capacity of a cellular system is increased by a factor N^2 as the size of the cell, i.e., its diameter, is decreased by a factor of N. This is due to the fact that, at least in principle, all frequencies in the mobile telephone spectrum are available for use in each independent cell. Thus, as the number of cells is increased, the total number of calls that can concurrently exist in an area is increased. A drawback, however, to decreasing the size of the cells is that a mobile unit tends to cross cell boundaries more often, requiring a larger number of handoffs which will tend to overload the mobile telephone switching office (MTSO) to the point where existing calls may be interrupted or dropped.

Personal communication service (PCS) functions in substantially the same manner as the mobile cellular system. In PCS, the user may be in a building or walking in a street or riding a vehicle and using a handset which communicates with a base station in the same manner that the mobile unit communicates with the base station or cell site in the cellular network. It is envisioned that PCS, by implementing very small cells, could provide service to a very large number of users, for example in a densely populated urban area. The difficulty with PCS is the same as in the cellular system in that handoffs become the bottleneck.

Modern cellular systems use what is known as code division multiple access (CDMA) spread-spectrum communications. In direct-sequence coding CDMA (DS-CDMA), the energy of the user signal is distributed uniformly over the system bandwidth through the spreading process providing separation between users of the same frequency in adjacent cells. A requirement of DS-CDMA is that no interfering signal received may be significantly stronger

than the desired signal since it would jam the weaker signal. This type of coding is used in what is sometimes referred to as hierarchal cell structures. The most commonly referenced hierarchal structure is a macro/umbrella cell overlaying a number of micro cells. A fast-moving mobile unit, for example, may be served by the macro cell to avoid an extreme number of handovers. Slow-moving users are allocated to micro cells to save capacity for the macro cells. Using the DS-CDMA concept, micro cells and macro cells share the same frequency. To avoid strong interference at a micro cell from mobile unit in communication with a macro base station, the output power of the mobile unit in the micro cell is increased to overpower the interfering signal. The use of hierarchal cell structure to provide high-quality speech, data communication at rates up to 2 megabits per second and video communication with mobile units travelling at rates in excess of 100 miles per hour and accommodating PCS are seen as needed to meet future mobile telecommunication demands.

In the hierarchal cell structure, the low tier, small cells, e.g., on the order of 100 feet in diameter, accommodate low speeds. The low speed is mostly pedestrian traffic and other traffic moving at speeds below 30 miles per hour. The advantages of small cells is low power, simple, inexpensive and light-weight terminals. What is desirable is an infra structure which allows use of such terminals in all applications, whether in the home or office as a cordless phone, on streets, in shopping malls, airports, etc., and in cars on expressways at highway speeds. Additionally, high-spectrum reuse is needed to provide low-cost, high-quality service which requires a large bandwidth for each subscriber.

To provide wire line toll, quality-voice service, a 32-kilobit per second bit rate is required with ADPCM coders. As wireless data services emerge, even more spectrum bandwidth will be required. In the future, it may be possible to utilize the spectrum in the 60 gigahertz range providing very large amounts of bandwidth. However, the radio wave characteristics at that frequency dictate a very short range, line of site propagation, requiring very small cells. However, as noted, small cells and fast-moving mobile units are incompatible due to the time required for handoff.

SUMMARY OF THE INVENTION

These and other problems of the prior art are overcome in accordance with this invention by means of a moving base station which is interposed between a moving mobile telephone unit and a fixed base station. In accordance with this invention, a movable base station moves with the traffic at a rate of speed which is comparable to the speed of the traffic and communicates with a moving mobile telephone unit via standard mobile radio transmission. The movable base station further communicates by radio signals with a plurality of fixed antennas spaced along the path of travel of the mobile base station. The several fixed antennas are connected to a telephone wire line network via a telephone gateway office in a standard fashion. In accordance with this invention, the fixed radio ports are synchronized and the interface between the moving base station and the fixed radio ports is a time division multiplexed (TDM) - direct-sequence, spread-spectrum CDMA.

In one particular embodiment, a number of fixed base stations are provided in addition to moving base stations allowing slower moving traffic, such as pedestrian traffic or rush hour mobile traffic to communicate via the fixed base stations.

In a specific embodiment of the invention, the moving base stations are provided with highly directional antennas directed to moving traffic and highly directional antennas directed to the radio ports. Communications from the fixed radio ports to the movable base stations are at a relatively low power level and from the movable base stations to the mobile units are at a relatively higher power level. Due to the characteristics of the direct-sequence, spread-spectrum CDMA, the higher power level signal will overpower the lower level signal such that the mobile unit does not receive communications from the fixed radio port but only from the movable base station. In the reverse direction, a low level of signal is transmitted from the mobile units to the movable base station and a high-level signal is transmitted from the base station to the fixed radio ports, thereby eliminating any direct communication from the mobile unit to the fixed radio port.

In one embodiment of the invention, the movable base stations are supported on a series of closed loops and ends of adjacent loops overlap to facilitate transfer of telephone cells between adjacent loops.

DETAILED DESCRIPTION

FIG. 1 is a diagrammatic representation of a mobile telecommunication system incorporating principles of the invention. FIG. 1 represents, for example, a divided highway with mobile units 20 traveling on a first roadway 10 in one direction and a plurality of mobile units 25 traveling along a second roadway 15, in the opposite direction. A plurality of moving base stations 30 are disposed along one side of the roadway 10. The base stations are spaced apart by a selected distance equivalent to the diameter of the cell served by the moving base station. The moving base stations 30 may be moved by means of a rail 35, or other suitable conveying device which may include an automotive vehicle travelling on the roadway, in the same direction as the traffic flow on the roadway 10, as indicated by the arrow 12. In a similar fashion, a plurality of moving base stations 40 are disposed adjacent the roadway 15 moving in the direction of the traffic as indicated by the arrow 17. The moving base stations 40 are moved along a rail 45. The moving base stations 30, 40 may be supported on any suitable conveying device such as rails 35, 45. The conveying device may be at ground level or overhead, depending on the terrain and available space for the device. The moving base stations are preferably disposed for optimum radio communication with the mobile units on the roadways.

Disposed between the moving base stations moving along the rails 35, 45 are a plurality of fixed radio ports 50 which are connected by means of a fiber optic ring 55 or a similar signal transmitting device to a telephone office connected to the wire line telephone network and referred to as a gateway office. The gateway office 60 forms the interface between the mobile telecommunication system and the wire line telephone network. The gateway office is a well-known equipment. It is part of the telephone network and is responsible for call processing in conjunction with the base stations. As described further later herein, the gateway office will include certain processor hardware and software to detect a best signal quality indication and to selectively transmit information with a best signal quality indicator to the

telephone network. A plurality of fixed base stations 70 are disposed in the vicinity of the roadway 10 and are connected to the gateway office 60 by means of a fiber optic ring 75 or similar signal transmission device.

In operation, the moving base stations 30 may move in the direction of the flow of the traffic at a rate of, for example, 60 miles per hour, which may be faster than some traffic and slower than other traffic. The moving base station preferably handles telecommunications with mobile units which travel at a rate of not more than 30 miles per hour faster or slower than the moving base station. For example, the moving base stations 30, 40 may be traveling at the rate of 60 miles per hour to accommodate traffic moving in the range of 30 to 90 miles per hour. In the arrangement of FIG. 1, fixed base stations 70 would accommodate communications with mobile units traveling at a speed of less than 30 miles per hour including pedestrian traffic and stationary units. It will be readily apparent that instead of having fixed and moving base stations as depicted in FIG. 1, slowly moving and rapidly moving units may be used as well. A particular moving base station is effective when the mobile units are moving in the same direction as a base station. FIG. 1 shows two roadways traveling in opposite directions with the moving base stations disposed between moving in the direction of the traffic. The base stations may also be placed on opposite sides of the same roadway with two-way traffic with the moving base stations moving in opposite directions on the opposite sides of the roadway.

In the typical cellular telephone system, the base station, also referred to as a cell site, forms an interface between the mobile unit and the gateway office. As such, the base stations may perform a number of functions, including functions such as locating a particular mobile unit, as well as voice processing and functions associated with call setup, call supervision, and call termination. Additionally, the base stations perform the function of handing off and receiving an existing call involving a mobile unit which has moved into or out of the normal service area of a base station. All of these are well-known base station functions. In some proposed mobile telephone systems, the base stations are primarily only radio interface units and a base station controller, connected to a plurality of base stations performs call-handling functions for the plurality of base stations. The system in accordance with the

invention differs from the prior art primarily in that the base stations 30, 40 are moving with the traffic and communicate with the gateway office 60 via fixed radio ports 50. Furthermore, the various call-handling functions, including handoff, are performed by the moving base station. Advantageously, because of movement of the base station in the same direction as the traveling mobile unit, the number of handoffs is greatly reduced.

Each of the moving base stations 30, 40 is provided with antennas 100, 101. The antennas 100, 101, preferably high gain, directional antennas for use in mobile communication, are well know and commercially available. The fixed base stations 70 are provided with four separate antennas 110 extending in four different directions. The antennas 100 on the base stations 30, 40 are used to communicate with the mobile units 20, 25 whereas the antennas 101 on the moving base stations 30, 40 are used to communicate with the fixed radio ports 50. The fixed base stations 70 are preferably each provided with four antennas 102-105. Fewer than four antennas may also be used. In that case, at least one omni-directional antenna is used. In the configuration of FIG. 1, the antennas 102 are arranged to communicate with the mobile units 20 and the antennas 103-105 are arranged to communicate with other mobile telephone communications from slow moving traffic or stationary subscribers. The fixed radio ports 50, in the configuration of FIG. 1, are each provided with a pair of directional antennas 110, 111 of the same general type as the directional antennas 100-105. As the moving base stations 30, 40 move relative to the fixed radio ports 50, data representing voice signals and call related information is transmitted between the antennas 101 on the moving base stations 30, 40 and the antennas 110, 111 on the fixed radio ports 50.

FIG. 2 is a diagrammatic representation of the fixed radio ports 50. The unit includes a standard microprocessor 150 as well as a radio interface circuit 154 providing an interface between the radio signals received on the antennas 110, 111 and the processor 150. The circuits are of a type typically used in fixed base stations and are well known in the art. Additionally, each radio port 50 includes a processor 150 connected to an add/drop multiplexer (ADM) 152. The ADM 152 interfaces with the fiber optic cable 55 and is able to add data from the processor 150 to the data stream on the fiber optic cable 55. Additionally, the ADM 152

recognizes a data stream accompanied by an address identifying the processor 150 and transfers such data from the data stream of the fiber optic cable 55 to the processor 150. As will be described further later herein, the processor 150 computes a signal quality indicator for the information received from the radio interface circuits 154, based primarily on radio signal strength intensity, in a well-known fashion. Processor 150 controls the transfer information between the fiber optic cable 55 and the various moving base stations via the antennas 110, 111.

FIG. 3 is a block diagram representation of one of the fixed base stations 70. The fixed base stations 70 perform the functions of a standard prior art fixed base station. The base stations 70 are connected to the fiber optic ring 75 and include an add/drop multiplexer (ADM) 162 which provides an interface between the processor 160 and the fiber optic ring 75.

As mentioned earlier, both the optical ring 55 and optical ring 75 are connected to the gateway office 60. The primary function of the gateway office is to provide the interface to a wired telephone network. It distributes the telecommunications traffic between the network and the moving base stations via the fixed radio ports. The fiber optic rings 55, 75 are preferably continuous rings with an add/drop multiplexer for each ring in the gateway office. Data transmission on the fiber optic rings 55, 75 is preferably in accordance with one of the well-known SONET or synchronous digital hierarchy (SDH) transmission protocols.

The directional antennas 100-105, 110, 111 may be of a sectorized architecture or may be phased array antennas with highly directional radio frequency beams. Such antennas are preferably used to decrease interference between the mobile base stations and the fixed radio ports, allowing greater spectrum reuse. Antenna diversity can be provided with two spatially separated radio beams separated in time with a predefined time-delay offset for easier separation at reception. Various techniques for obtaining high antenna diversity are well known in the art and antennas employing such techniques are commercially available.

FIG. 4 is a block diagram representation of the moving base station 30. The station 30 includes a processor 130 connected via radio interfaces 132, 134 to the antennas 100, 101, respectively. The processor 130 may be a standard microprocessor and the radio interface circuits 132 may be standard radio interface circuits. The microprocessor is preferably

programmed to handle the call processing functions performed in a prior art system by a call site or by a shared base station controller. In this manner, the moving base station has greater autonomy and requires less communications with a shared base station controller or the like. The circuits 132, like the radio interface circuits 154 in the fixed radio port 50 and the radio interface circuits 164 in the fixed base station 70, are well known and commercially available circuits.

The radio interface between the mobile units 20, 25 and the moving base stations 30, 40 and the fixed base station 70 is a standard radio interface, well known in the art. The radio interface between the moving base stations 30, 40 and the fixed radio ports 50 is preferably a time division multiplexed, direct-sequence, spread-spectrum, code-division multiple-access interface (TDM/CDMA). Multiple channels between the base station and the fixed radio ports are time division multiplexed as time slots in a data stream. The data stream is spread with a pseudo-random code over the allocated spectrum. A pilot sequence is inserted in the transmitted signal for ease of synchronization in a well-known manner. The interface between the movable base station and the fixed radio port is preferably transparent to the overall system in spectrum use.

Frequency division or time division may be used for duplex communications. In the frequency division duplex (FDD) mode, data is simultaneously transmitted in both directions, each in a different spectrum band. In a typical system in the FDD mode, the TDM frame transmission duration will be approximately 500 microseconds making the interface substantially transparent to overall system delay.

The interface between the mobile unit and the movable base may be the standard IS-95-based PCS air interface standard. The channel capacity for the so-called "extended mode" (2.5 mhz) has been determined to be seven channels at 32 kilobits per second. The FCC allocated licensed spectrum for personal communications services (PCS) includes 10-mhz licenses and 30-mhz licenses. Each 10-mhz license provides two separated 5-mhz bands and each 30- mhz license provides two separated 15-mhz bands, for two-way communications. Two 5-mhz bands can support 14 duplex channels at 32 kilobits per second and two 15-mhz bands can support 42 duplex channels at 32 kilobits per second.

Voice signals between a mobile unit and the gateway office are encoded in a standard fashion using ADPCM voice encoding with a minimum bit rate of 32 kilobits per second in each channel. The interface between the moving base station and the fixed radio port is adapted to carry up to 19 channels of 32 kilobits per second each at 16 bits per time slot. The frame structure includes 16 bearer channels of 32 kilobits per second at 16 bits per time slot. The time division multiplexed frame rate between the movable base station and the fixed radio port is 608 kilobits per second. To achieve a processing gain of 9 decibels, the frame rate is multiplied by a factor of 8, yielding 4,864 kilobits per second, which fit into a single 5-mhz band. FIG. 6 is a tabular representation of the channel allocation showing 16 bearer channels plus 3 channels for signalling, control, and error code. FIG. 7 is a representation of channels 18 and 19 of FIG. 6.

The moving base stations are addressed using predefined code sequences derived in a known manner by the use of Walsh functions. U.S. Pat. 5,103,349 entitled "System and Method for Generating Signal Wave Forms in CDMA Cellular Telephone System" describes the use of Walsh functions for code generation. U.S. Pat. 5,103,349 is incorporated by reference herein. As described in that patent, by choosing a Walsh function of order 8 provides 8 orthogonal codes in the present embodiment using spread spectrum CDMA uses the all 0 Walsh sequence as a pilot carrier with the other 7 sequences available for moving base station communications. The code sequences may be repeated as ABCDEFG; ABCDEFG; . . . Although fewer codes could be used, preferably no less than 3 are used. Because of differing propagation times for signals between a particular moving base station and two or more different fixed radio ports, it is not possible to satisfy the condition of time alignment required for Walsh function orthogonality for 2 or more fixed radio ports at one time. For this purpose, two outer pseudonoise codes are used to provide discrimination between signals arriving at the moving base station from different fixed radio ports. The pseudonoise code rate is preferably 4,864 kilobits per second. The sequence length for the transmitted carrier signal is preferably 32,768 chips, as described in U.S. Pat. 5,103,459. The outer pseudonoise codes modulate the signal in quadrature phase shift keying.

The pilot signal will be transmitted in both directions, from the moving base stations to the fixed radio ports and vice, versa. This is made possible by the line of site fading characterized as Rician.

The pilot sequence will be long enough that a number of different sequences can be generated by shifts in the basic sequence. The separation will be great enough to ensure that there is no interference between pilot signals. Each moving base stations will use a different offset from a neighboring moving base station to provide signal separation. Similarly, each fixed radio port will use a different offset from a neighboring fixed radio port.

The FCC has allocated a 20 mhz of unlicensed spectrum, including a 10 mhz band for voice products and a 10-mhz band for data products. Thus, one continuous 10-megahertz channel is available and time division multiplex transmission is preferably used. The bit rate for both directions of transmission will be twice the frequency division duplex rate, introducing an overall delay of 500 microseconds and a processing gain of 9 decibels. In the time division duplex mode, the transmission times and direction, forward and reverse between the mobile unit and the moving base station and between the moving base station and the fixed radio ports, are aligned. In one half of the time division, duplex cycle signals are transmitted from the mobile unit to the moving base station and, from there, to the fixed radio port. In the other half-cycle, signals are transmitted from the fixed radio port to the moving base station and then to the mobile unit.

The two 15-mhz licensed spectrum bands (30 mhz) are preferably divided into three 5-megahertz channels in each direction, utilizing the same architecture as described earlier herein with respect to the 5-megahertz licensed spectrum. In the 15-mhz licensed spectrum, each of the 5-megahertz channels will support 14 traffic channels, for a total of 42 traffic channels in each 15-mhz band. The air interface between the moving base station and the fixed radio port, as well as the signal structure, can be modified and adapted to a variety of allocations of spectrum and air interface standards.

In the present embodiment, as described earlier herein, 7 orthogonal codes are available for communication between the fixed radio ports 50 and the moving base stations 30,

40. As described earlier herein and depicted in FIGS. 6 and 7, one 16 bit communication channel, channel 19, is set aside for control and identification bits. As depicted in FIG. 7, channel 19 may comprise 7 control bits and 9 identification bits. The 9 identification bits provide 512 unique identification numbers. Using 7 orthogonal codes and 512 identification numbers, 3,854 moving base stations can be uniquely identified. When the moving base stations are separated by a spacing of 200 feet, the total distance of coverage using the 3,854 moving base stations is approximately 135 miles. FIG. 1 shows a portion of the system with moving base stations moving in opposite directions along oppositely directed roadways and fixed radio ports with dual antennas. Vehicular traffic moving in opposite directions on the same roadway are preferably served by moving base stations on opposite sides of the roadway. Where each roadway has only one-way traffic, the system is preferably disposed between the roadways. In one embodiment of the invention, depicted in FIG. 9, two separate loops 200, 205 are disposed between two separate roadways 206, 208 with the traffic on the roadways indicated by the arrows 207 and 209. The loops 200 and 205 comprise moving base stations 210 and 250, respectively. The base stations, in this embodiment, are moving in the direction indicated by the arrows 201 and 202. Since, as a practical matter, the loops 200, 205 are not of indefinite length, a plurality of loops may be required to cover a desired area. To avoid interruption in communications, the ends of the loops are preferably sufficiently close together, or overlapping, to provide an overlapping area of coverage for mobile units traveling in the area of the loop ends. This will allow one of the mobile stations nearing the end of the loop of which it is a part to hand off the call to a mobile station of the adjacent loop.

Each loop preferably has a single gateway for connection to the wire telephone network. One advantage of that arrangement is that it eliminates the need for registration of moving base stations, which is required where a moving base station moves between gateways. FIG. 9 shows a pair of gateways 215 associated with the loop 200 and a pair of gateways 255 associated with the loop 205. The two gateways of a loop are both connected to the fixed radio ports of the loop at all times and may be operated in a load sharing mode with each capable of

handling the total telecommunication's traffic for the loop in the event of a failure in one of the gateways.

To avoid interrupting communications with a mobile unit traveling along the roadway in the area where two adjacent loops end, any existing calls are handed off from the moving base station near the terminating end of its loop to a moving base station of the next loop. The handoff process is essentially the same as a handoff between moving base stations on the same loop, except that the handed off call will be routed to the wire network to a different gateway. This procedure is equivalent to a handoff between cell sites of different cells in the existing cellular network in a manner which is well known in the art. The loops 200 and 205 may physically overlap to assure proper overlap of communications between moving base stations of the two loops and to avoid loss of communication with a mobile unit handed off from one loop to another.

The timing and synchronization between the moving base station and a fixed radio port with which the moving base station communicates is phase-locked to the pilot signals received from the fixed radio port with which the moving base station communicates. For synchronization purposes, the moving base station will receive a Global Positioning Satellite (GPS) Coordinated Universal Time (UCT) timing signal once each second.

CDMA Technology is well-known for sensitivity to power control. Specifically, the more powerful signals tend to "mask out" less powerful signals at the receiver. Typically, elaborate power control schemes are implemented to ensure that all signals arrive at the receiver at the same level. In accordance with the system of this invention, however, the sensitivity to power level of CDMA is used to advantage. The principles of signal transmission employed in the system of the invention is illustrated in FIG. 8. Two power levels of radio transmission, high (H) and low (L), are defined. Referring to FIG. 1, high-power level signals are transmitted from the moving base station 30 to the mobile unit 20 and from the base station 30 to the fixed radio port 50. Low power level signals are transmitted from the fixed radio port 50 to the moving base station 30. Similarly, low power signals are transmitted from the mobile unit 20 to the moving base station 30. Since the moving base station receives a low power level signal from the fixed

radio port and transmits a high level power signal toward terminals, the high power level received at the mobile unit 20 will mask out any signals of the low power signal transmitted from the fixed radio port to the moving base station. In a similar fashion, any low signal transmitted from the mobile unit 20 reaching the fixed radio port 50 will be masked by the high power level signal transmitted from the moving base station to the fixed radio port. As stated earlier, the antennas 100-105, 110, 111 are preferably highly directional antennas with very little feedback from the transmit signal to the receive signal. Feedback due to reflections and other extraneous sources can be readily eliminated at the moving base station using well-known noise cancellation techniques.

When a mobile unit set is first powered up or first enters a service area, the mobile unit must register in the manner described earlier, by transmitting its unique address in the new service area. The address will be received by the closest moving base station 30 and transmitted via a fixed radio port and the gateway switch 60 to the telephone network. This registration procedure is required so that an incoming call for the mobile unit can be appropriately directed.

The spacing of mobile based stations 20 and the fixed radio ports 50 of FIG. 1, together with the strength of the signal transmitted between the moving base stations and the fixed radio ports, determines the number of fixed radio ports with which a moving base station can communicate at any point in time. The spacing and signal strength is preferably such that each fixed radio port receives signals from three moving base stations. When a fixed radio port receives data, accompanied by the identification number of the moving base station, the processor 150 (FIG. 2) computes a signal quality indication on the received signal. The signal quality indication is a figure of merit preferably computed as a function of signal strength and signal-to-noise ratio. It is added to the received data and added to the fiber optic ring 55 via the ADM 152. The gateway 60 preferably receives the same data from several different ones of the fixed radio ports 50 and stores the data in an internal memory in the gateway 60 in association with the moving base station identification number and Walsh function spreading code. The address of the fixed radio port from which the data has been received is stored in the memory of processor 64 as well. Accordingly, multiple copies of the same data transmitted by a single

moving base station are stored in the memory of the processor 64 in the gateway. The signal quality indications computed by the processors 150 in each of several fixed radio ports are compared to a predefined signal quality indication threshold, and the data corresponding to a signal quality indication below the threshold value is discarded. Otherwise, the data is retained. A cyclic redundancy code transmitted with the data is used to detect any TDM frame errors. The best data, i.e., associated with the best signal quality indication is transferred from the gateway 60 to the telephone network. Data received from the telephone network at the gateway 60 and intended for a registered mobile unit is stored in the memory of the processor 150 in a register particularly associated with the moving base station currently serving the mobile unit. This data will be sent via the optical ring 55 to all fixed radio ports that are identified in the memory of the processor 65 as fixed radio ports with an acceptable signal quality indication. The received data will be transmitted from each of the fixed radio ports which received the data together with the identification code and Walsh function code of the moving base station to which the data is directed. The transmission of data from different fixed radio ports will be staggered, delayed by different amounts, so that they can be received and separated at the moving base stations. The delays can be precisely controlled by means of synchronous distribution via the optical ring 55, in the SONET or SDH format. The receiving moving base station, by means of its processor 130, compares the multiple copies of the received data signals, aligns them and combines them for the best reception.

Each of the moving base stations will have one of N assigned codes, where N may be any number, but preferably is at least 3 or more. Seven Walsh function codes are preferably used. The codes may be repeated in sequence, as for example, ABCDEFGABCDEFG. The codes are assigned in sequence to the various moving base stations so that two moving base stations having the same code will be physically separated by a sufficient distance to prevent interference in the communications between fixed radio ports and moving base stations having the same identity code. The operation of the fixed base stations 70 is essentially the same as that of a standard fixed base station. In congested traffic areas, a mobile unit which is stopped or slowly moving, e.g., less than 30 miles per hour, will preferably be serviced by one of the fixed

base stations 70. As the speed of travel of the mobile unit 20 increases, a handoff will occur between the fixed base station and a moving base station. The procedures for determining whether a mobile unit is to be served by a fixed base station or a moving base station are the same procedures as described earlier herein in determining which moving base station is selected to serve a mobile unit, i.e., based on signal strength and error rate. Thus, when a call involving a mobile unit is initiated or when it is determined that a handoff should occur, the mobile unit may be handed from a moving station to a fixed station, or vice versa. Each mobile unit monitors pilot signals from fixed and moving base stations and synchronizes to the base station providing the best signal. The mobile unit may "connect" with three fixed or moving base stations while searching for a fourth in what is known as the "soft" hand-off mode. As the speed of the vehicle increases, fixed or slow moving base stations will be dropped. In more congested areas where traffic speed will vary between 0 and 60 miles per hour, base stations speed may, for example, be set to move at 30 mph. The moving base station should then be able to accommodate all traffic in the 0-60 mph range.

It will be understood that the above-described arrangement is merely illustrative of the application of the principles of the invention and that other arrangements may be devised by those skilled in the art without departing from the scope of the invention as defined by the appended claims.

CLAIMS

WHAT WE CLAIM IS:

1. Interface apparatus for establishing signal connections between a telephone office connected to a telephone network and mobile telephone units transmitting radio signals and moving in a specified direction, the interface apparatus comprising:

a stationary interface unit connected to the telephone office via a signal transmission connection;

a plurality of spaced apart movable base stations, each of the base stations uniquely associated with the telephone office and supported on a conveying device for limited

movement in the specified direction within an area defined relative to the stationary interface, the movable base stations each responsive to radio signals transmitted by the mobile telephone units to transmit corresponding radio signals to the stationary interface unit and the stationary interface unit responsive to the radio signals transmitted from the movable units to transmit signals corresponding to the signals transmitted from the movable units to the telephone office via the signal transmission connection.

2. The interface apparatus in accordance with claim 1 wherein the mobile telephone unit moves along a roadbed and the movable interface unit is movably supported on conveying apparatus disposed along path extending parallel to the roadbed.

3. The interface apparatus in accordance with claim 2 wherein the conveying apparatus comprises a rail movably supporting the movable interface unit.

4. The interface apparatus in accordance with claim 2 wherein the stationary interface unit is disposed on one side of the conveying apparatus opposite the roadbed.

5. The interface apparatus in accordance with claim 1 wherein the movable interface unit comprises signal processing circuitry and a first radio antenna directed toward the mobile telephone unit and a second radio antenna directed toward the stationary interface unit and wherein the stationary interface unit comprises signal processing circuitry and a radio antenna directed toward the movable interface unit, the movable interface unit responsive to radio signals received at the first antenna to transmit corresponding radio signals via the second antenna to the stationary interface unit and the stationary interface unit responsive to radio signals received via the radio antenna of the stationary interface unit to transmit corresponding signals to the telephone office via the signal transmission connection.

6. The interface apparatus in accordance with claim 1 wherein each of the movable base stations has an associated service area and each of the movable base stations is operative to hand-off and receive existing calls to mobile units in an associated service area.

7. The interface apparatus in accordance with claim 1 wherein each of the movable base stations has an associated service area and each of the movable base stations is operative to perform a plurality of functions including locating an identified mobile unit in an associated service area.

8. The interface apparatus in accordance with claim 1 wherein the radio signals transmitted between the movable interface unit and the stationary interface unit are transmitted in accordance with a code division multiple access, direct sequence, spread spectrum transmission signalling protocol.

9. The interface apparatus in accordance with claim 8 wherein signals transmitted from the mobile telephone unit to the movable interface unit are transmitted at a first power level and signals transmitted from the movable interface unit to the stationary interface unit are transmitted at a second power level higher than the first power level.

10. The interface apparatus in accordance with claim 8 wherein data transmitted between the stationary interface unit and the movable interface unit is transmitted in a time division duplex manner.

11. The interface apparatus in accordance with claim 8 wherein data transmitted between the stationary interface unit and the movable interface unit is transmitted in a frequency division duplex manner.

12. The interface apparatus in accordance with claim 8 wherein each movable interface unit is synchronized to a selected stationary unit by transmission of pilot signals to the selected unit.

13. The interface apparatus in accordance with claim 1 wherein the movable interface unit is responsive to radio signals received from the stationary interface unit to transmit corresponding radio signals to the mobile telephone unit and wherein signals transmitted from the stationary interface unit to the movable interface unit are transmitted at a first power level and signals transmitted from the movable interface unit to the mobile telephone unit are transmitted at a second power level higher than the first power level.

14. Interface apparatus for establishing signal connections between a telephone office and a plurality of mobile telephone units transmitting radio signals, certain of the mobile telephone units moving in a specified direction, the interface apparatus comprising:

a plurality of movable interface units uniquely associated with the telephone office; and

a plurality of stationary interface units connected to the telephone office via a signal transmission connection;

each of the movable interface units movable in the specified direction and within a limited area defined relative to the stationary interface units and responsive to radio signals transmitted by a mobile telephone unit to transmit corresponding radio signals in the direction of the stationary interface units, each of the stationary interface units responsive to radio signals transmitted from an adjacent movable unit to transmit signals corresponding to the signals transmitted from the adjacent movable unit to the telephone office via the signal transmission connection.

15. The interface apparatus in accordance with claim 14 wherein:

the movable interface units are movable along an interface unit path extending in a direction parallel to the predefined path and having a first side adjacent the predefined path;

the stationary interface units are spaced apart and disposed on a second side of the interface unit path opposite the first side of the interface unit path;

each of the movable interface units comprises signal processing circuitry and an associated first radio antenna directed toward the first side and an associated second radio antenna directed toward the second side;

each of the stationary interface units comprises signal processing circuitry and an associated radio antenna directed toward the interface unit path;

each of the movable interface units is responsive to radio signals received at the associated first antenna to transmit radio signals via the associated second antenna to the stationary interface unit; and

each of the stationary interface units is responsive to radio signals received via the associated radio antenna to transmit corresponding signals to the telephone office via the signal transmission connection.

16. The interface apparatus in accordance with claim 14 wherein the movable units move along the interface unit path at a predefined speed.

17. The interface apparatus in accordance with claim 16 wherein the predefined speed is a function of an average speed of the plurality of mobile telephone units.

18. The interface apparatus in accordance with claim 14 and further comprising a plurality of mobile telephone units moving along another path in an opposite direction opposite the specified direction and a plurality of movable interface units movable in the opposite direction and wherein:

the plurality of mobile telephone units moving in the specified direction move along a first roadbed and the plurality of mobile telephone units moving in the opposite direction move along a second roadbed spaced apart from the first roadbed;

the plurality of movable interface units movable in the specified direction are disposed along one side of the first roadbed adjacent the second roadbed;

the plurality of movable interface units movable in the opposite direction are disposed along one side of the second roadbed adjacent the first roadbed; and

the plurality of stationary interface units are disposed between the plurality of movable interface units movable in the specified direction and the plurality of movable interface units movable in the opposite direction.

19. The interface apparatus in accordance with claim 14 and further comprising a plurality of stationary interface units connected to the telephone office via a signal transmission connection and responsive to radio signals transmitted by a mobile telephone unit to transmit corresponding signals to the telephone office.

20. The interface apparatus in accordance with claim 14 wherein each of the movable base stations has an associated service area and each of the movable base stations is operative to perform hand-off and receiving functions relative to existing calls for mobile units within an associated service area.

21. The interface apparatus in accordance with claim 14 wherein each of the movable base stations has an associated service area and is operative to perform a plurality of functions, including locating an identified mobile unit in an associated service area.

22. The interface apparatus in accordance with claim 14 wherein the telephone office is connected to a telephone network and wherein a plurality of stationary interface units are responsive to radio signals transmitted by an identified one of the movable interface units and

each stationary interface unit responsive to radio signals from the identified movable interface unit is operative to compute a signal quality indication for data represented by the transmitted radio signals and to transmit to the telephone office data signals corresponding to the transmitted radio signals together with a corresponding signal quality indication, the telephone office responsive to the receipt of the data signals and signal quality indication to transmit to the telephone network data received from a selected one of the stationary interface units having a preferred signal quality indication.

23. The interface apparatus in accordance with claim 14 wherein each of the stationary units is responsive to a data message received from the telephone office to transmit a corresponding radio message to selected ones of the movable interface units and wherein the telephone office is operative to transmit a predetermined data message intended for a selected one of the movable interface units to selected ones of the stationary interface units and each of the selected ones of the stationary interface units is responsive to receipt of the predetermined data message to transmit corresponding radio signals to the selected one of the movable interface units.

24. The interface apparatus in accordance with claim 23 wherein the predetermined data message is transmitted to each of the selected ones of the stationary interface units in a timed sequence and the selected ones of the stationary interface units transmits the corresponding radio signals in a corresponding timed sequence.

25. A mobile telephone system comprising:

a telephone office connected to a telephone network;

a stationary interface unit connected via a signal transmission connection to the telephone office;

a movable interface unit uniquely associated with the telephone office and movable at a predetermined speed along a first predefined path of travel and in a direction

defined by a direction of travel of a mobile telecommunication unit traveling along a second predetermined path defined within a limited area defined relative to the stationary interface;

the stationary interface unit comprising signal processing circuitry and a stationary interface radio antenna directed toward the first predefined path of travel;

the moving interface unit comprising signal processing circuitry and a first radio antenna directed toward the second predefined path of travel and a second radio antenna directed toward the stationary interface unit;

the moving interface unit responsive to radio signals received at the first radio antenna to transmit corresponding radio signals via the second radio antenna to the stationary interface and the stationary interface responsive to radio signals received at the stationary interface radio antenna to transmit corresponding signals to the telephone office via the signal transmission connection.

26. A mobile telephone system arranged for communication with mobile telephone units and comprising:

first and second telephone offices connected to a telephone network;

a first closed loop having opposite ends and a second closed loop having opposite ends, one of the opposite ends of the first loop disposed adjacent one of the opposite ends of the second loop, each of the loops movably supporting a plurality of movable base stations;

a plurality of stationary interface units disposed adjacent each of the loops, each connected to one of the telephone offices;

each movable base station communicating with a stationary interface unit and responsive to radio telephone signals transmitted by a mobile telephone unit to establish a telephone communication connection with one of the telephone offices via one of the stationary interface units;

the telephone offices operative to record position of each of the movable base stations on each loop and to transmit an alert signal via one of the stationary interface units to an identified movable base station approaching one of the opposite ends of one of the loops;

the identified movable base station responsive to the alert signal to indicate to mobile units communicating with the identified movable base station to establish a telephone communication connection to another base station.

27. The system in accordance with claim 26 wherein one of the opposite ends of one of the loops overlaps one of the opposite ends of another of the loops.

28. The apparatus in accordance with claim 1 wherein the movable interface unit is further responsive to radio signals received from the telephone office via the stationary interface unit to locate an identified mobile unit and to transmit to the identified mobile unit signals corresponding to radio signals received from the telephone office.

29. The apparatus in accordance with claim 1 and comprising a plurality of stationary interface units and wherein the area is defined relative to the plurality of interface units.

MOBILE COMMUNICATION SYSTEM WITH MOVING BASE STATION

ABSTRACT

A mobile communication system employs moving base stations moving in the direction of flow of traffic moving along a roadway. The moving base station communicates with fixed radio ports connected to a gateway office. A plurality of moving base stations are spaced apart on a closed loop and move with the flow of traffic along one roadway on one leg of the loop and with a flow of traffic on another roadway in another leg of the loop. The moving base stations communicate with a plurality of fixed radio ports connected by a signal transmission link to a gateway office which, in turn, is connected to the wire line network. The moving base stations are each provided with a pair of directional antennas with one antenna directed toward the flow of traffic and another antenna directed to the fixed radio ports.

::ODMA\PCDOCS\GRR\345131\1

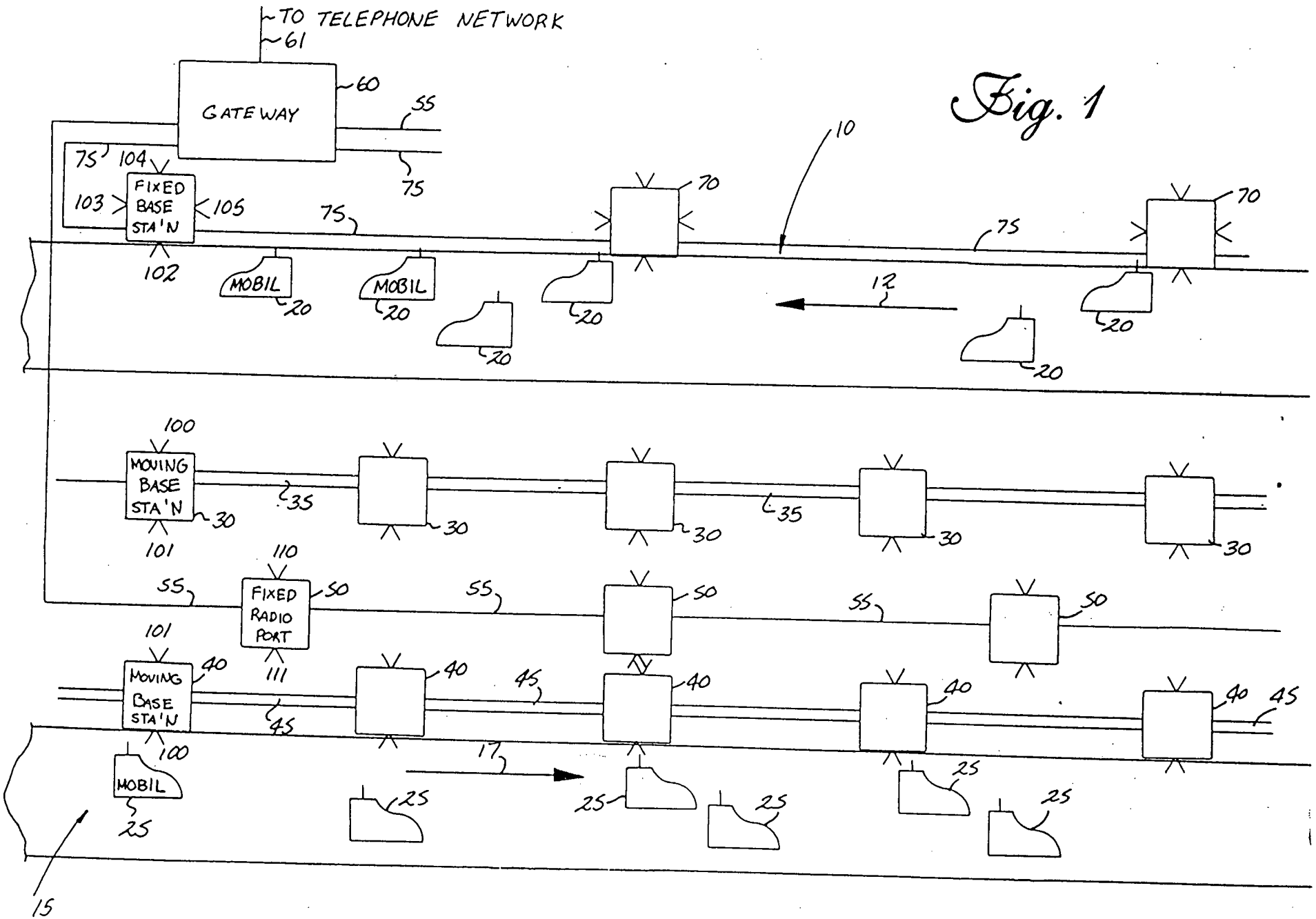

TO TELEPHONE NETWORK
61
GATEWAY
60
55
75
104
FIXED BASE STA'N
103
105
102
MOBIL
20
70
10
12
100
MOVING BASE STA'N
30
35
101
110
FIXED RADIO PORT
50
111
40
45
MOBIL
25
17
15

Fig. 1

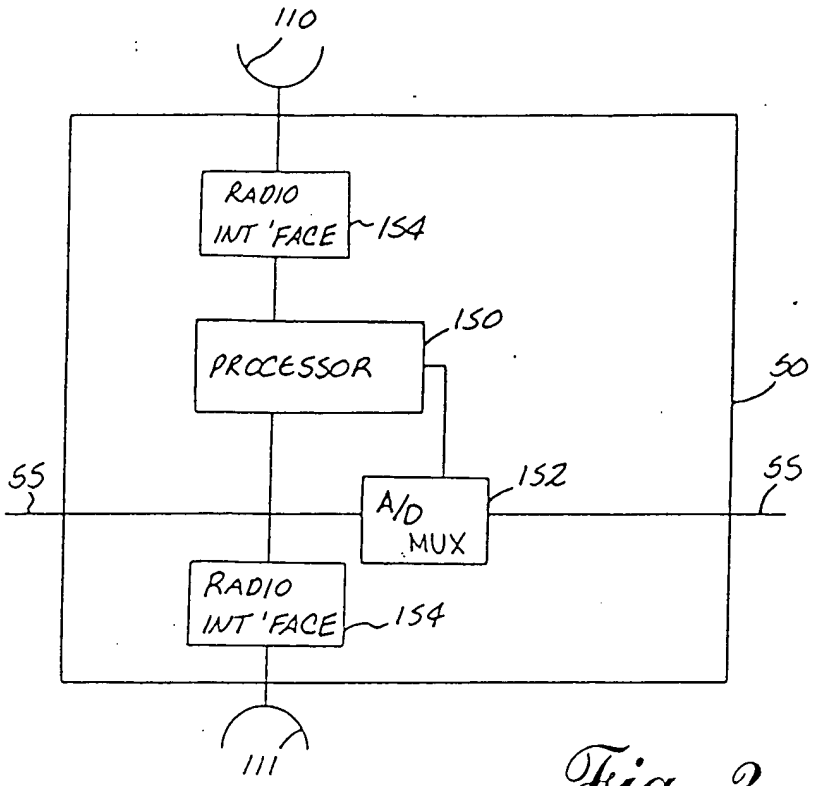

110
RADIO INT'FACE
154
PROCESSOR
150
50
55
A/D MUX
152
55
RADIO INT'FACE
154
111

Fig. 2

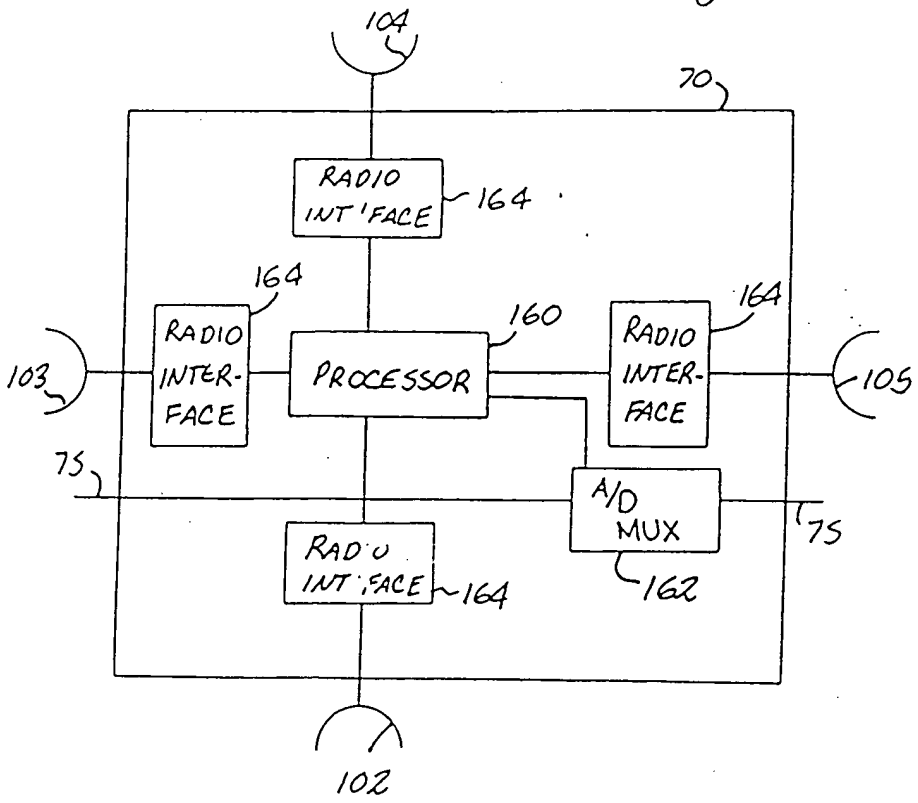

104
70
RADIO INT'FACE
164
164
RADIO INTER-FACE
160
PROCESSOR
164
RADIO INTER-FACE
103
105
75
A/D MUX
75
RADIO INT'FACE
164
162
102

Fig. 3

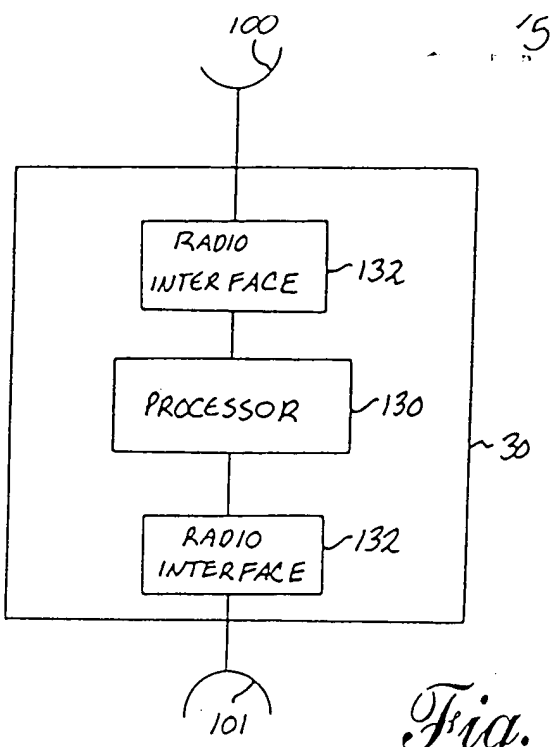

100
15
RADIO INTERFACE
132
PROCESSOR
130
30
RADIO INTERFACE
132
101

Fig. 4

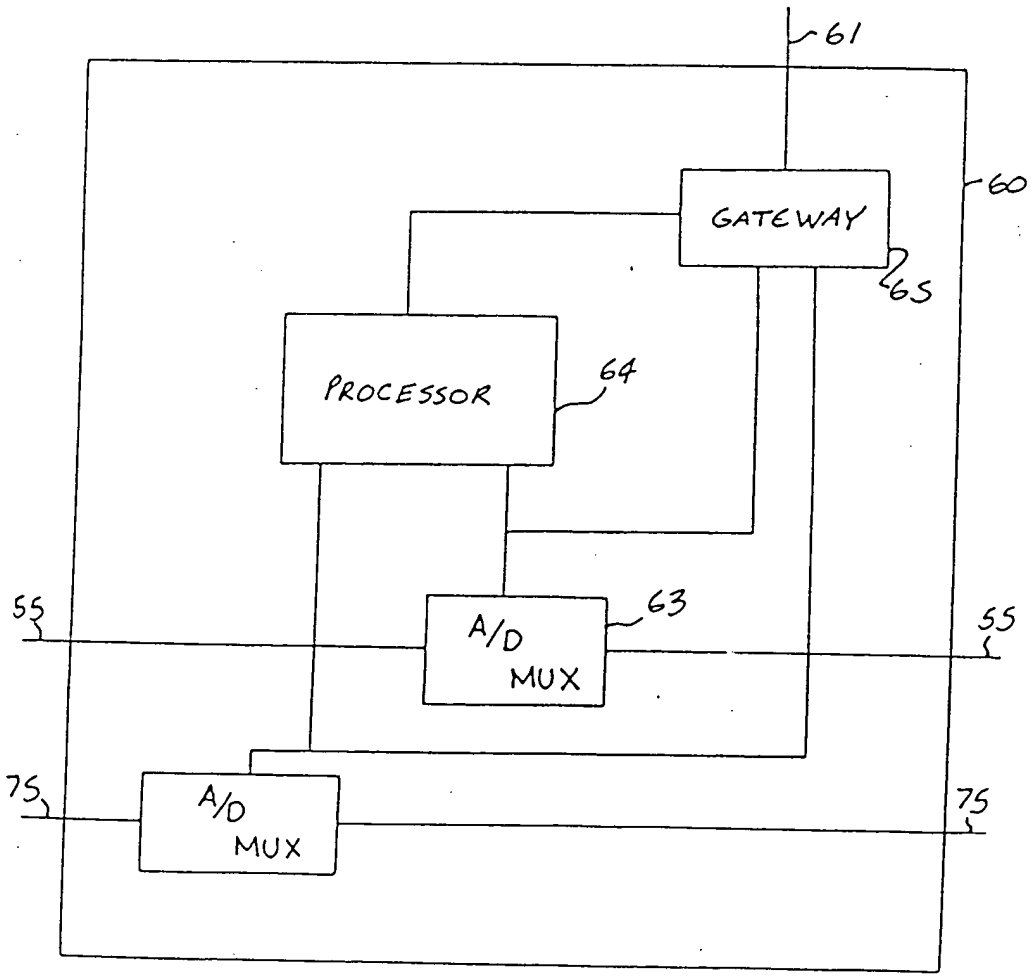

61
60
GATEWAY
65
PROCESSOR
64
55
A/D MUX
63
55
75
A/D MUX
75

Fig. 5

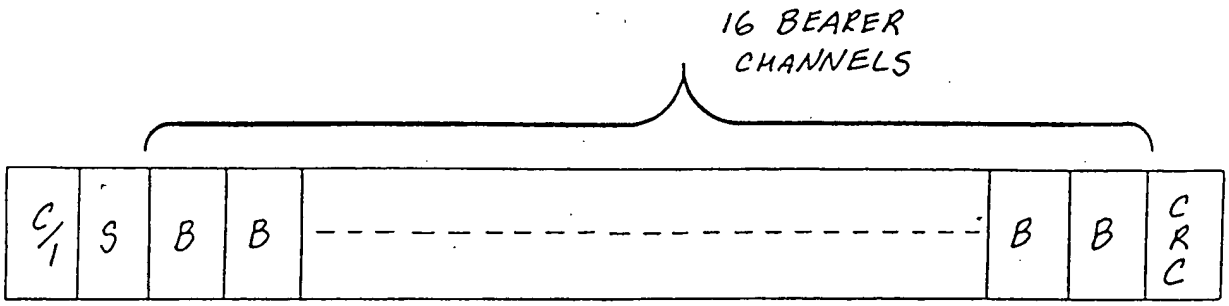


Fig. 6

Fig. 7

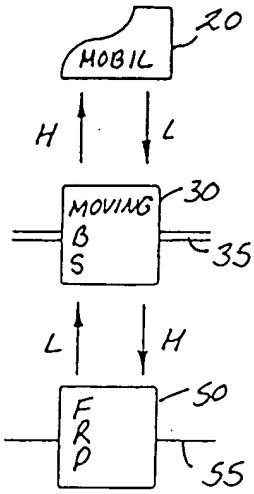


Fig. 8

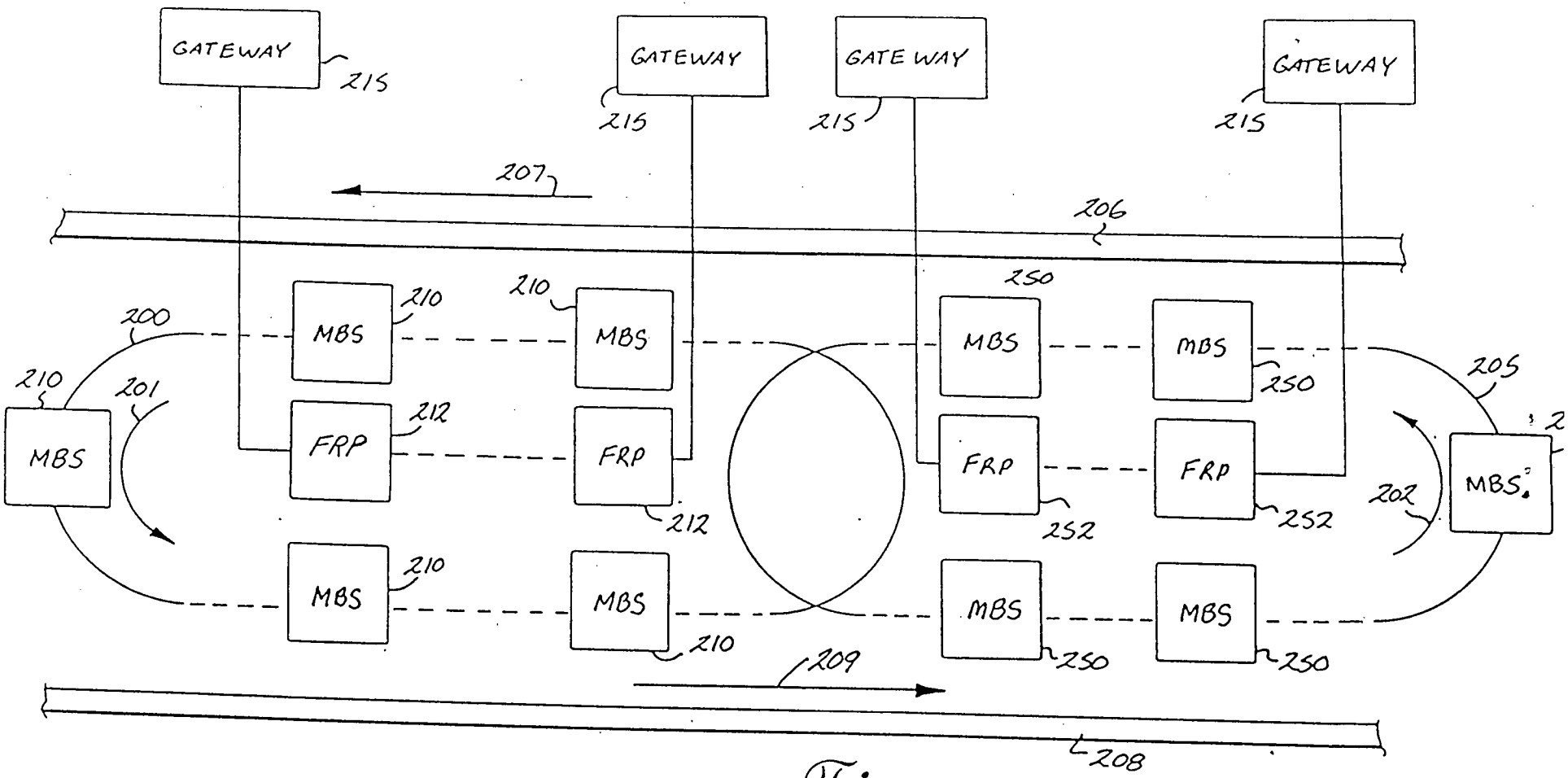

GATEWAY
215
GATEWAY
215
GATE WAY
215
GATEWAY
215
207
206
200
210
MBS
210
MBS
250
MBS
MBS
250
205
210
201
MBS
FRP
212
FRP
212
FRP
252
FRP
252
202
MBS
MBS
210
MBS
MBS
210
MBS
250
MBS
250
209
208

Fig. 9